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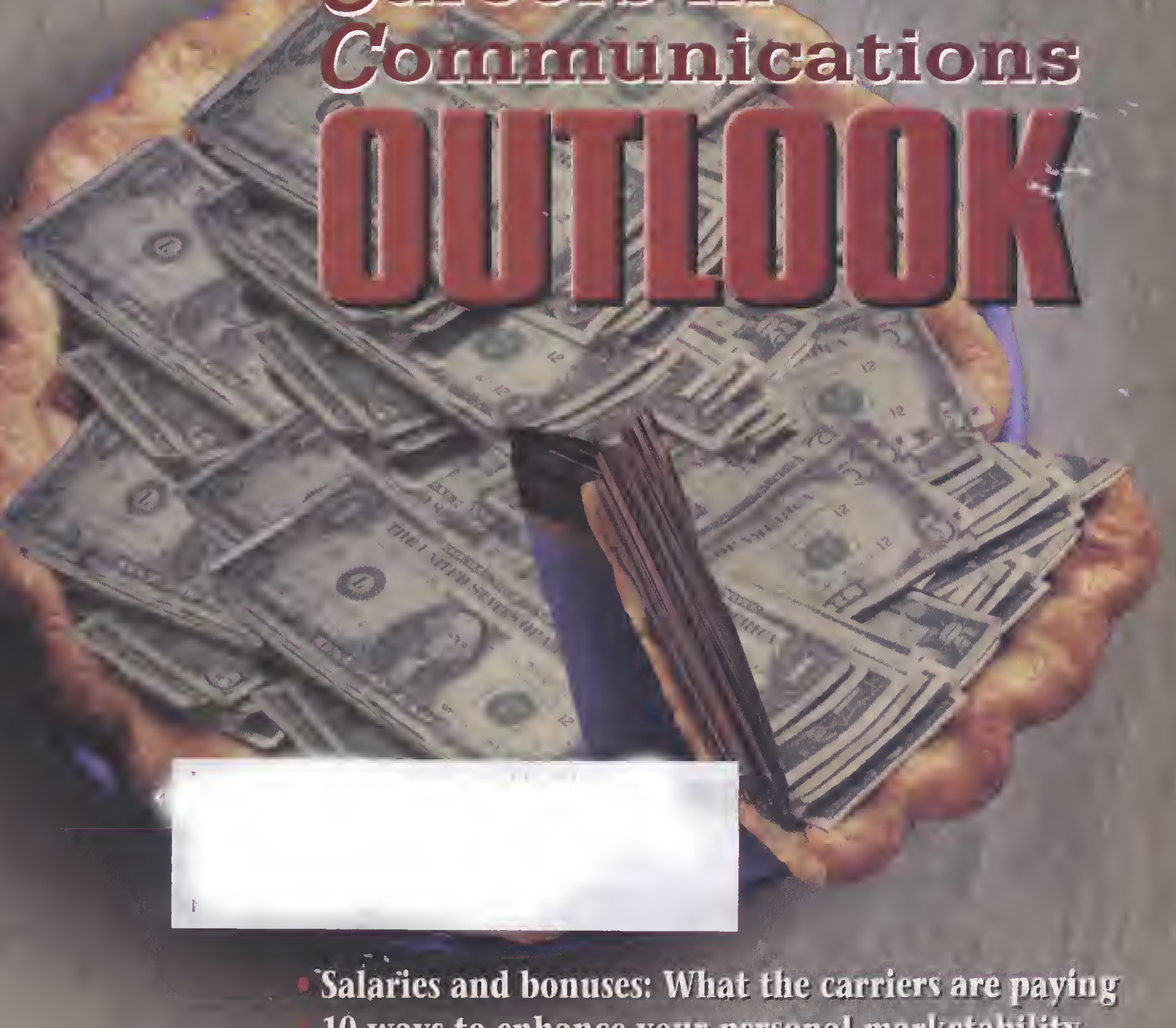

1998
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OUTLOOK

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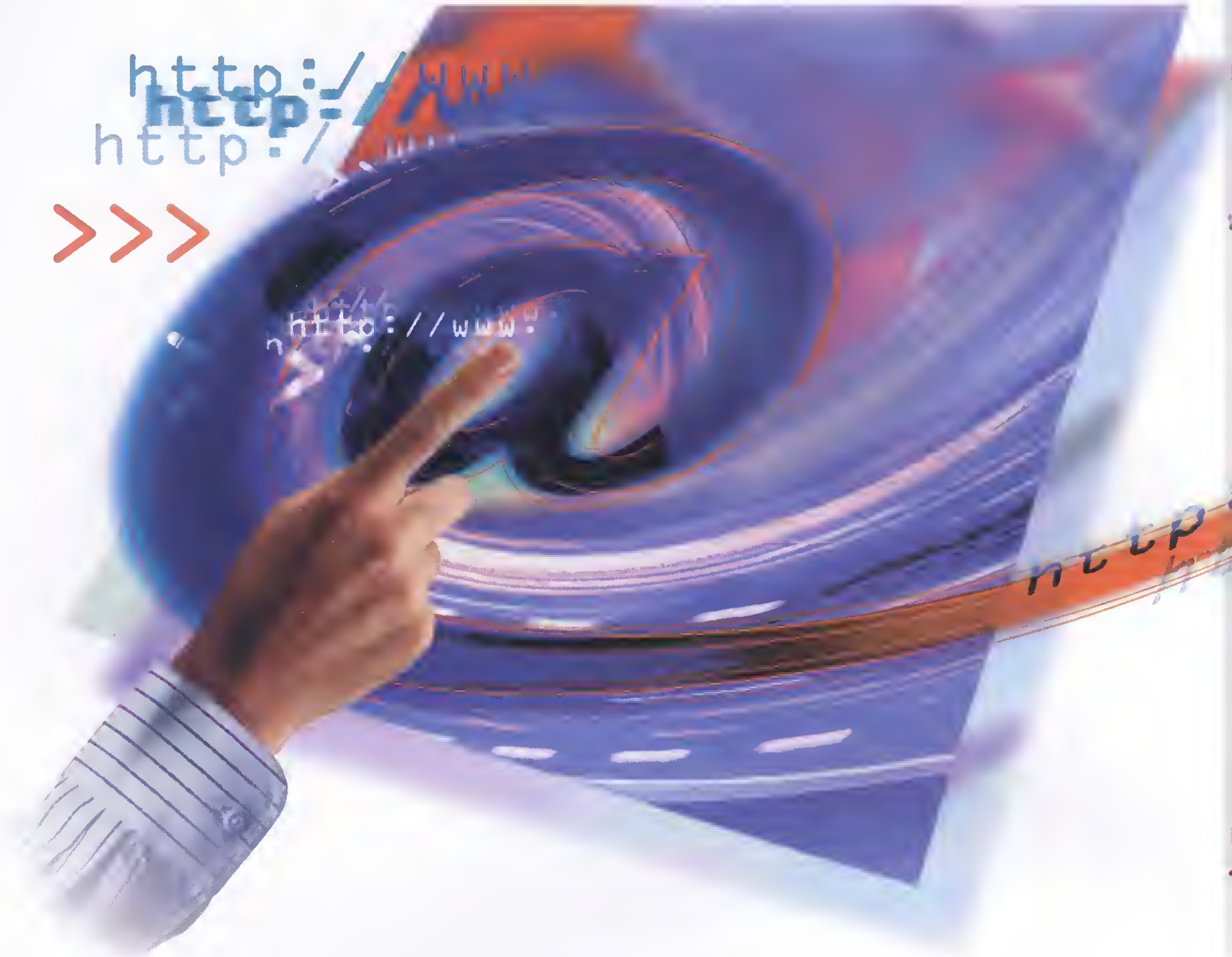

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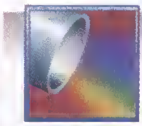

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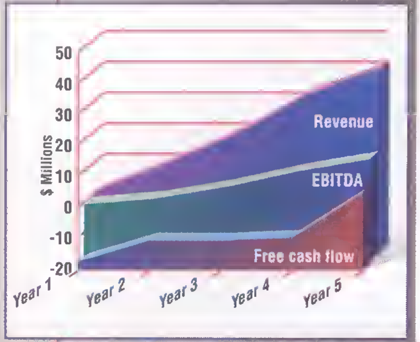

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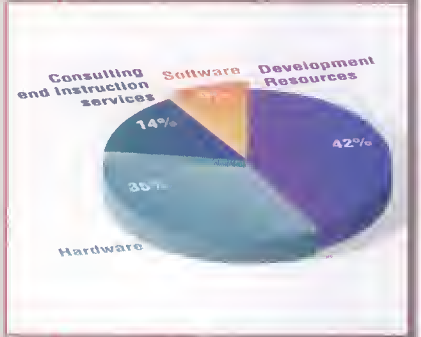

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Our cover story separates CDMA fact from fiction, and begins on Page 22.
Cover illustration by Jon Fraze

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Circle 101

CHARLES MASON

Let's move on

Having covered the wireless industry for the past decade, I've watched the evolution of The Great Air Interface Debate with a lot of interest.

I've had the opportunity to use all of the technologies, from field-trial stage to when they were commercially deployed. As a Sprint subscriber, I use CDMA on a daily basis at home in Seattle, as well as when traveling in other cities.

I have witnessed careers placed on the chopping block in defense of an air interface technology. I also have seen healthy debate, where intelligent men and women rationally differ. GSM, IS-136 and CDMA all work; they just work differently. Each has its place, depending on a carrier's needs.

I've also seen much innuendo and back-stabbing. Few companies have come under more attacks than Qualcomm Inc. Given some of the comments I've heard over the years, you'd think the company was part of a grand conspiracy to undermine motherhood.

One would assume that after about 10 years of this, something would give. Something has. IS-95, or cdmaONE as it's now called, is alive and well, offering customers reliable service in dozens of markets. It gives carriers a chance to offer quality voice services today and enhancements tomorrow. The technology will allow them to grow their businesses. CDMA is not perfect; vendors and carriers alike have encountered problems. But it works.

Sadly, the air interface wars have distracted the wireless industry from much more important issues, such as Where do we go from here? What are tomorrow's enhanced services and how will we make them possible? The sniping and back-biting over RF interfaces have become counterproductive.

"Over the longer term, industry challenges are not about RF issues. They are not about specific RF standards. They are about adding value," says Jane Zweig, senior vice president at Herschel Shosteck Associates Ltd.

Zwieg notes that the focus must shift away from hierarchical to distributed network architectures—from hardware- to software-based functionality. It must shift to the types of services that can drive demand and, ultimately, profits. It must shift to an open software platform that will cross all wireless business units. Infrastructure vendors must consider alliances with software giants, such as Microsoft and Sun.

These are but a few of the key issues facing the wireless industry. As difficult as it is for the critics and competitors to accept, CDMA works. Now, let's debate the future—not the past.

Charles Mason

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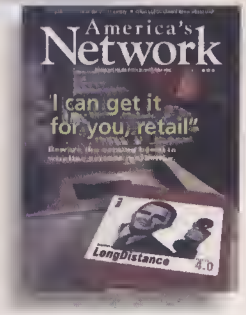


The article, "Generation gaps" (Oct.15) focusing on Always On/ Dynamic ISDN (AO/DI) was great. I am excited about the AO/DI capability and the potential it offers to ISDN customers, Internet service providers and corporate intranets. It appears that AO/DI will transition from concept to service in less than one year, with customer provider equipment manufacturers now producing product. Our BellSouth ISDN service is widely deployed and is fully capable of supporting AO/DI today.

BellSouth completed the first phase of its AO/DI concept trial in September and demonstrated the capability at Networld+Interop in Atlanta in October. BellSouth also participated in presentations and demonstrations of AO/DI at the recent North American ISDN Users' Forum (NIUF) conference in Savannah, Ga. These presentations and demonstrations were targeted toward informing ISPs of the benefits supporting AO/DI for Internet access. I believe that the emergence of AO/DI demonstrates that customers, equipment vendors, applications developers, and service providers recognize the functionality and availability of ISDN.

Have something to

SAY?

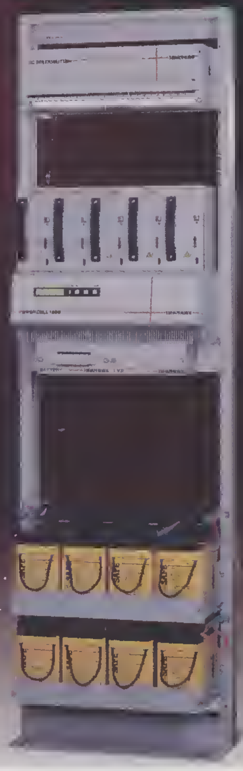
Send your comments to Editor, *America's Network*, 201 Sandpointe Ave., Suite 600, Santa Ana, CA 92707; fax 714/513-8634 or e-mail at editors@americasnetwork.com. Comments may be edited for clarity and length.

As noted in the article, "ISDN has continued to grow in popularity and accumulate customers that can't wait for a multimegabit solution to their bandwidth needs." I tend to side with those who believe ISDN will see its most significant growth ever during 1998 and beyond as customers, application developers, and service providers fully recognize the functionality and availability of ISDN relative to other alternatives.

Bill Jerome
Project Manager- ISDN Integration
BellSouth
Atlanta

Clarification

Contrary to information presented in our Nov. 15 issue, contributing author Gabor Kiss is a senior engineer for Bellcore (Morristown, N.J.). *AN* regrets the error.



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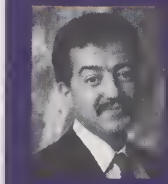

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JOSEPH LIAS

Easy broadband access

The telecom Swiss Army knife adds a blade.

In "Taking the lead," (From the Editors," Aug. 15) senior editor Annie Lindstrom wondered how telcos are "coping with the onslaught of choices they need to consider before implementing solutions." That made me think: It is that very dilemma that those of us in the integrated access solutions industry use as a template to shape our products. Integrated access solutions combine transport technologies onto single platforms that let network service providers make those choices on the competitive fly. Since emerging in the early 1990s, integrated access systems have evolved with the industry's changing competitive climate.

Integrated access solutions provide network operators an alternative to constructing individual networks for every service. They make provisioning services only slightly more complicated than sliding a modular service card into a chassis housing the backplane. With a screwdriver and laptop computer to configure the system, a telco can conquer new territory in as little as an hour.

A DYNAMIC GAME NEEDS FLEXIBLE PLAYERS

Early in the decade, we witnessed the proliferation of data services. Integrated services digital network (ISDN), frame relay, asynchronous transfer mode (ATM) and Internet protocol (IP) all blossomed in a relatively short period of time. Driving the trend were enterprises scrambling to take advantage of the Internet and telecommuting, with small and home offices further spurring the trend. As these services expanded exponentially, Congress split the nucleus of industry with the 1996 Telecommunications Act, causing a competitive fission unlike any before in American industry.

Suddenly, players joined the competitive fray, each carving out different niche. To play, however, they had to be flexible. Business customers were filling their shopping baskets with services as though they were strolling through some sort of digital supermarket. Service providers needed a way to respond without the time and capital costs of constructing separate data networks.

According to The Yankee Group, only one out of six medium or large businesses employ access services at T1 speeds and above. Given the market's current pace, those businesses will grow to more than half by 2001. That growth demands taking the benefits of integrated access to a broadband level. In response, integrated bandwidth optimizers have emerged.

Like integrated access solutions, integrated bandwidth optimizers combine services onto a single platform and transport medium.

Like integrated access solutions, integrated bandwidth optimizers garner efficiencies by combining services onto a single platform and transport medium. As a result, service providers can manage an array of technologies, including T1, T3, digital subscriber line (xDSL), frame relay and ATM, on a single system, transporting them as appropriate via time division multiplexing (TDM) or ATM on a synchronous optical network (Sonet)/synchronous digital hierarchy (SDH) network. These units also cost significantly less than deploying independent ATM, xDSL, TDM or frame relay infrastructures.

OPENING GATES TO NEW MARKETS

Network efficiencies aside, integrated bandwidth optimizers will appeal most to telcos with competitive fur bristling on their backs. Because integrated bandwidth optimizers are cost-efficient and quick to deploy, they lend themselves to widespread deployment. Thus marketers will no longer squeeze through slowly opening doors into new markets, but will step unimpeded through wide open gates.

The multifunction platform has some built-in capabilities that let service providers offer new services. For example, exploiting the digital-cross-connect capabilities of integrated bandwidth optimizers, carriers can channelize a T3 running from a business park to the central office to market fractional T3 service. The portfolio of services for integrated bandwidth optimizers is based on a modular approach. Deploying new services is simply a matter of inserting and configuring the appropriate card. New revenue streams could conceivably begin in hours, not days.

With the advent of integrated bandwidth optimizers, integrated access solutions may earn a reputation as the telecom equivalent of the Swiss army knife. No matter what the competitive situation, there's a blade that will work. ■

Joseph Lias is vice president of marketing for Premisys Communications (Freemont, Calif.)

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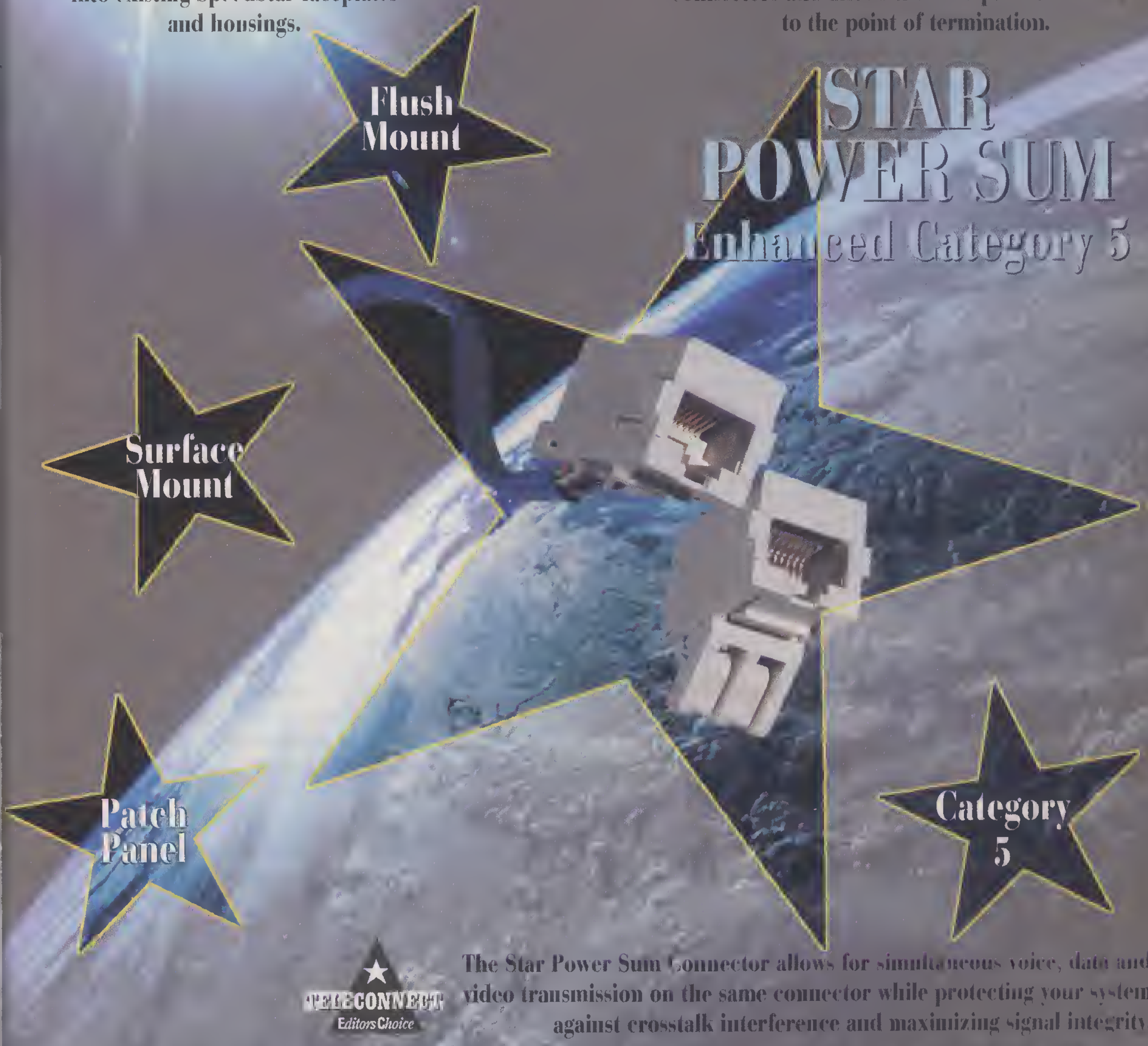

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SUSAN BAHR

Senate signals new FCC

Legislators want latest FCC team to keep a keen eye on universal service, relationship with states.

The new, five-member team at the Federal Communications Commission bears specific directives for action from the Senate. Bill Kennard, who was FCC general counsel, now is FCC chairman.The other three new commissioners are Harold Furchgott-Roth, former chief economist for the House Commerce Committee; Michael Powell, formerly chief of staff for the Antitrust Division of the Department of Justice; and Gloria Tristani, former commissioner on the New Mexico State Corporation Commission. Susan Ness, who was a commissioner under former chairman Reed Hundt, has stayed on.

At the Senate Commerce Committee confirmation hearings and floor debate in October, the Senate used the opportunity to express concerns on a variety of issues, from Bell operating company (BOC) entry into the interLATA market to the federal preemption of local zoning ordinances.

UNIVERSAL SERVICE AND RURAL AREAS ...

Even the Senate roll call vote was used to send a message about universal service to the new commission. Sen. Conrad Burns (*R*-Mont.) cast the one and only vote against Kennard. The other three commissioners were confirmed by unanimous consent.

Burns is particularly concerned about the 25%-to-75% split between federal and state universal service support for high-cost areas. As noted by Sen. Byron Dorgan (*D*-N.D.), many states have not had universal service programs. By requiring them to provide 75% of the support, states such as North Dakota and South Dakota are going to "get clobbered." If the FCC cannot define universal service support so that there aren't substantial telephone rate increases across the country, then the FCC should be abolished, according to Dorgan.

Commissioner Tristani is concerned that federal provision of only 25% of universal service support may be insufficient. She would support a review of that rule. Due to her experience in New Mexico, Tristani is a strong advocate for issues affecting rural residents and rural telephone companies.

Kennard said the 1996 Act requires support from both jurisdictions. He stated that after the FCC and the states have formulated plans for eliminating implicit subsidies embedded in existing pricing structures and moved these subsidies into explicit universal service funds, the FCC must determine whether additional federal support for universal service is needed. He said he would reexamine the current cap on universal service for rural, insular and high-cost areas if the support would not be sufficient to meet the universal service goals of the 1996 Act.

When asked about a pending request filed by 130 rural telcos to stay the universal service order, Powell said he would be sensitive to claims that the order harms rural telephone companies.

... AND PAGING COMPANIES

Sen. Burns expressed concern that paging companies providing interstate service must contribute to universal service although they are not eligible to receive universal service support. However, none of the four new commissioners was familiar with this issue at the time of the hearings.

Kennard pointed out that the 1996 Act envisions that

The FCC's new team (left to right): Commissioner Michael Powell, Commissioner Gloria Tristani, Chairman William Kennard, Commissioner Susan Ness, and Commissioner Harold Furchtgott-Roth some parties, such as competitive local exchange carriers (CLECs), may contribute to universal service, although they may not be eligible to receive support. He stated, however, that if making contributions while not receiving support poses a unique burden on a particular group, the FCC should look at the issue.

INTRASTATE RATES

Kennard has few disagreements with decisions made under his predecessor's leadership. He agrees with the decision to adopt guidelines for intrastate prices, and, therefore, disagrees with the decision of the Eighth Circuit Court of Appeals striking down the FCC's local competition order in this regard.

But now, the FCC is imposing similar intrastate pricing guidelines on BOC requests for interLATA authority. States have appealed this decision, but Ness calls the appeal "frivolous." Sen. John Ashcroft (*R*-Mo.) feels Kennard's support for the FCC's policies on intrastate rates raises serious questions about Kennard's intent to carry out the letter of the law. (Powell appears to be at odds with Kennard; he believes the Eighth Circuit's decision leaves the FCC with little power, if any, over intrastate prices.)

Kennard agrees with the previous commission's decision to adopt guidelines for intrastate prices.

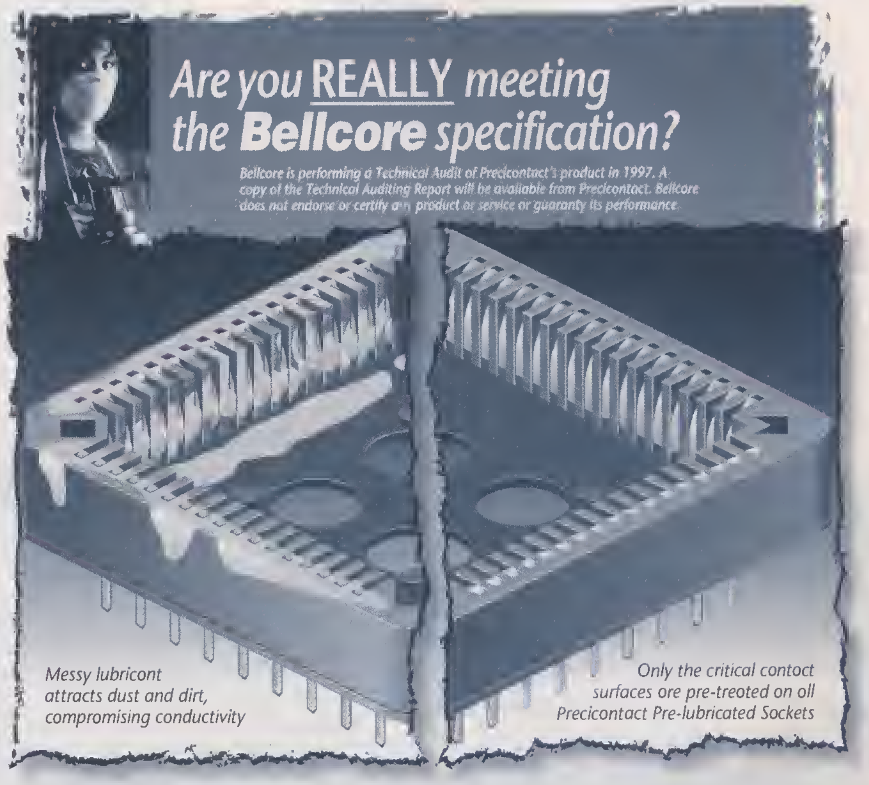
These court appeals impede competition, according to Kennard, because they impose uncertainty on the prices incumbent local exchange carriers may charge competitors. Kennard points to the lack of development of operations support systems (OSS) for use by competitors as another roadblock to local service competition.

Kennard wants the standards for interLATA authory to be clear. Powell feels that uncertainty is a barrier to entry. One thing is certain: the new commissioners have a steep learning curve on BOC requests for interLATA authority. They must rule on BellSouth's South Carolina request by the end of this year, and on BellSouth's Louisiana request by early February.

HANDS-OFF INTERNET APPROACH

All of the new commissioners agree to refrain from regulating the Internet. Ness' Internet motto is: "Observe, support, but do not interfere."

Sen. Burns and Sen. Ted Stevens (*R*-Alaska) challenged the FCC's decision to provide universal service support for Internet access for schools while Internet service providers (ISPs) do not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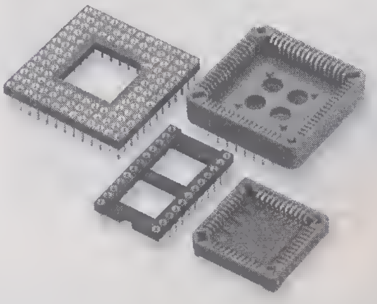


contribute to universal service. The FCC's intent was to increase school demand for Internet services, lowering costs and increasing the base of ISPs, according to Kennard. The program should be left alone for the time being, he says. Ness says ISPs contribute to universal service indirectly through the rates they pay for their telephone service.

Three of the commissioners say that preemption of state and local wireless zoning ordinances should be a last resort.

WIRELESS ZONING

A clear signal was sent from the Senate on zoning. Wireless service providers that need to construct towers are often confronted with state and local zoning ordinances that prohibit tower construction in technologically ideal locations. Furchgott-Roth, Tristani and Powell say preemption of state and local zoning ordinances should be a last resort.

In response to Sen. Kay Bailey Hutchison's (*R*-Texas) concerns about undue federal preemption, Kennard suggested that the commission work with local governments and the industry to try and develop best-practice model solutions, rather than make case-by-case decisions. If Kennard doesn't follow through, however, Hutchison promised to submit legislation to curb FCC authority.

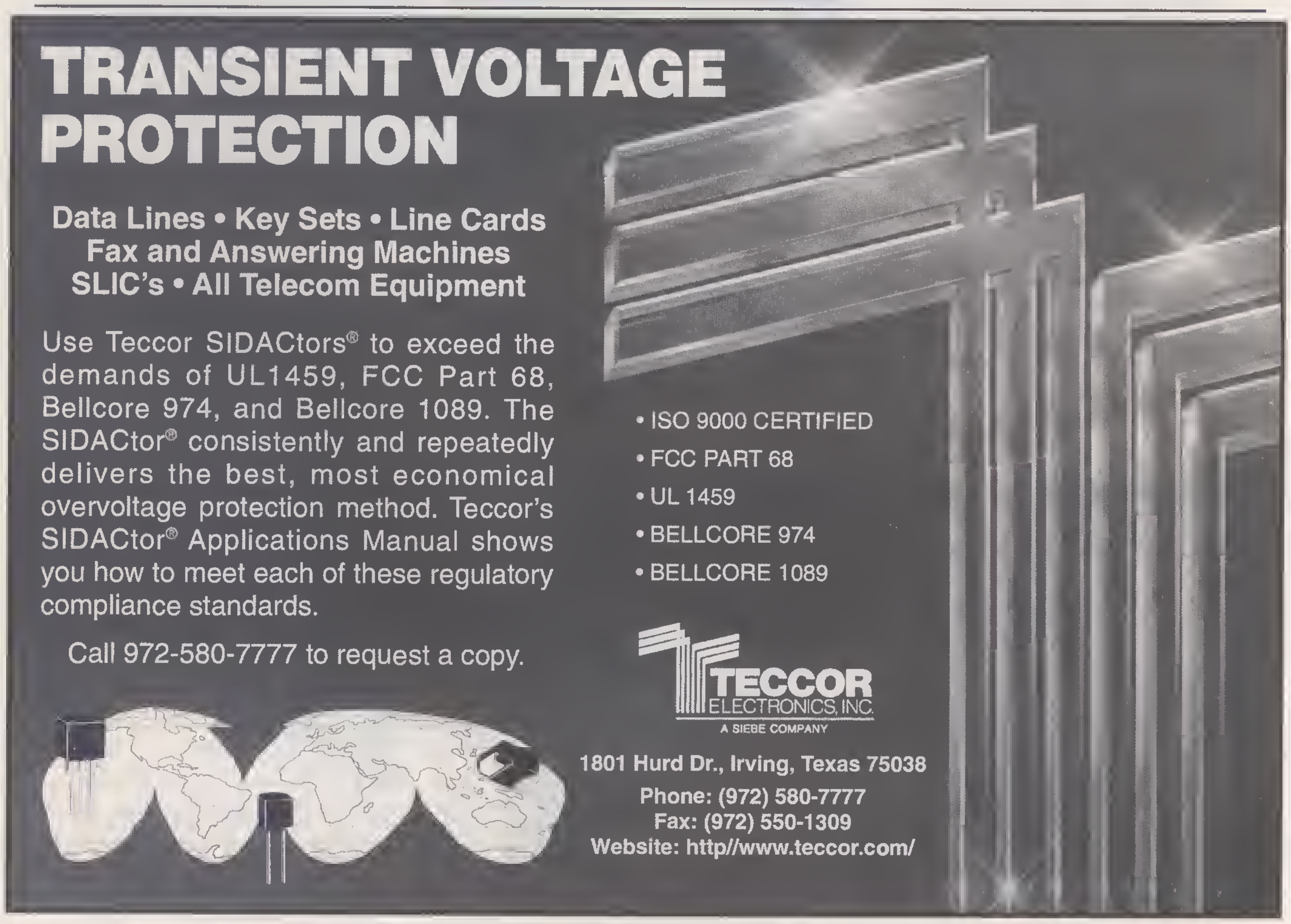
IMMEDIATE IMPACT

The Senators' messages were not lost on the outgoing FCC Commissioners. In the confirmation hearings, Sen. Ashcroft expressed his concern that the licensing of low-earth orbit satellites (LEOs) had been pending for five years. Less than one week later, the outgoing commissioners quickly adopted rules for LEO licensing.

The Senate has clearly told the new commissioners to focus on universal service and local competition, and to refrain from regulating the Internet and unduly preempting state and local zoning ordinances.

Under Kennard, the commission likely will continue existing FCC policies for the most part, while showing a greater sensitivity to issues concerning rural areas, minorities, low-income consumers and the disabled, as well as the relationship between the commission and the states. ■

Susan Bahr is a telecommunications attorney with Blooston, Mordkofsky, Jackson & Dickens in Washington and can be reached at sbahr@aol.com. (Article does not constitute legal advice. Persons seeking legal guidance for specific situations should seek direct counsel.)



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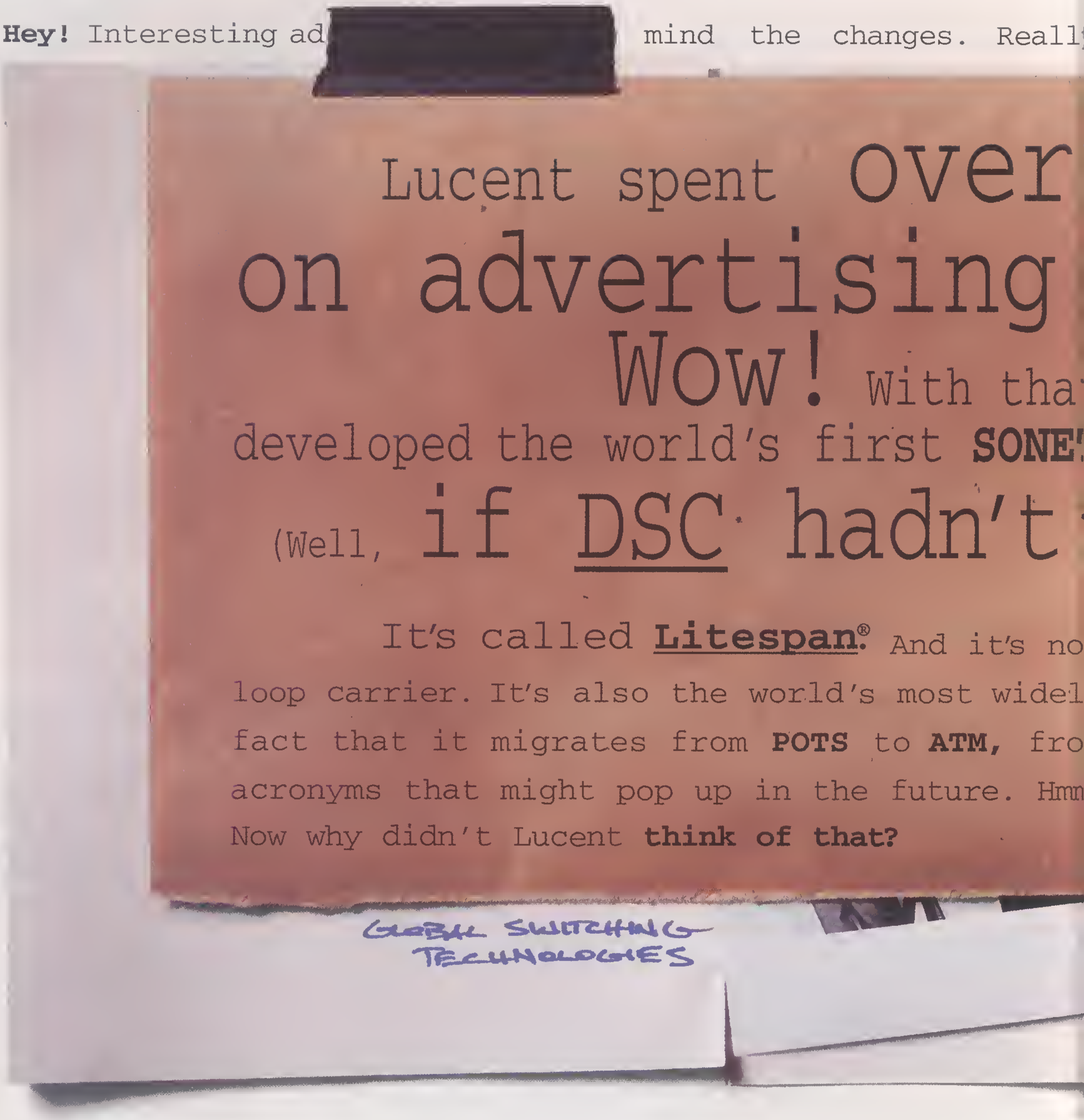

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Circle 108

The Resilience Factor

AN's salary and career trends study shows that, if you've made it this far, you're in good stead, indeed.

THOSE WORKING FOR THE NATION'S SERVICE PROVIDERS MAY BE SOMEWHAT DEPRESSED OVER NEAR-CONSTANT CORPORATE MAKEOVERS AND THE FRENETIC PACE OF THE INDUSTRY—BUT THEIR SALARIES ARE A DIFFERENT STORY.

ACCORDING TO THE RESULTS OF *AN*'S CAREERS IN COMMUNICATIONS SURVEY, *AMERICA'S NETWORK'S* PUBLIC CARRIER READERS ENJOY FAIRLY COMFORTABLE EARNINGS AND SURPRISINGLY STABLE CAREERS IN AN INDUSTRY FRAUGHT WITH MERGERS, ACQUISITIONS, DOWNSIZINGS, STARTUPS AND GENERAL JOB SHAKEUPS.

Figure 1:
What traits enhance your personal marketability in the telecom industry?

	% responses
Technical knowledge and skill	84.8
Specific technical experience:	
- Network services and design (19.4%)	
- Data communications (13.8%)	
- Outside plant/installation (13.2%)	
- Central office switching (13.2%)	
- Software platforms & programming (12.5%)	
- CATV and multimedia (11.3%)	
- Transmission (8.8%)	
- Internet (7.5%)	
- Wireless (6.2%)	
Interpersonal/communication skills	35.6
Management and leadership skills	26.3
More than 10 years' experience in industry	22.5
Hybrid technical/business background	20.8
Sales/marketing/business development acumen	19.1
Adaptability/flexibility/willing to learn	16.9
General industry knowledge	15.4
Critical thinking and problem-solving abilities	14.4
Personal career achievements/results-oriented	10.9

Figure 2:
Job function by gender

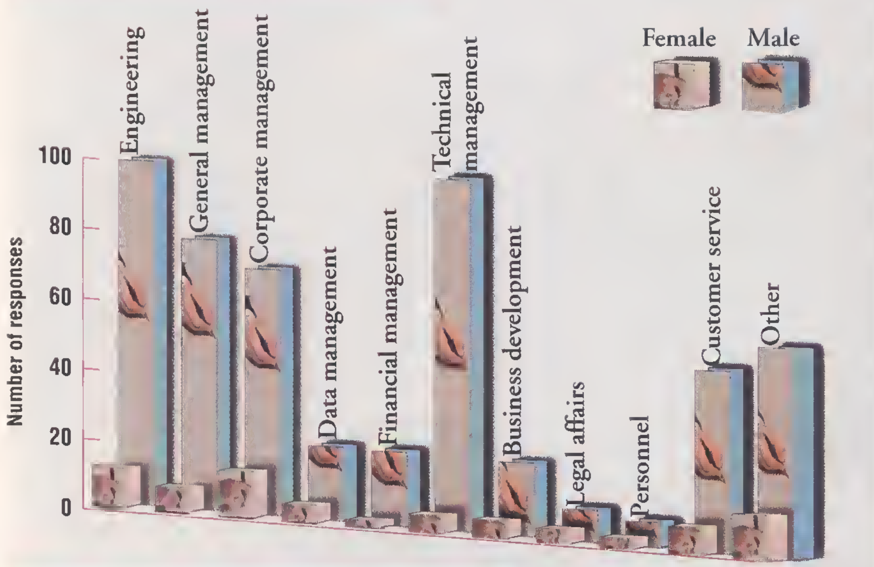
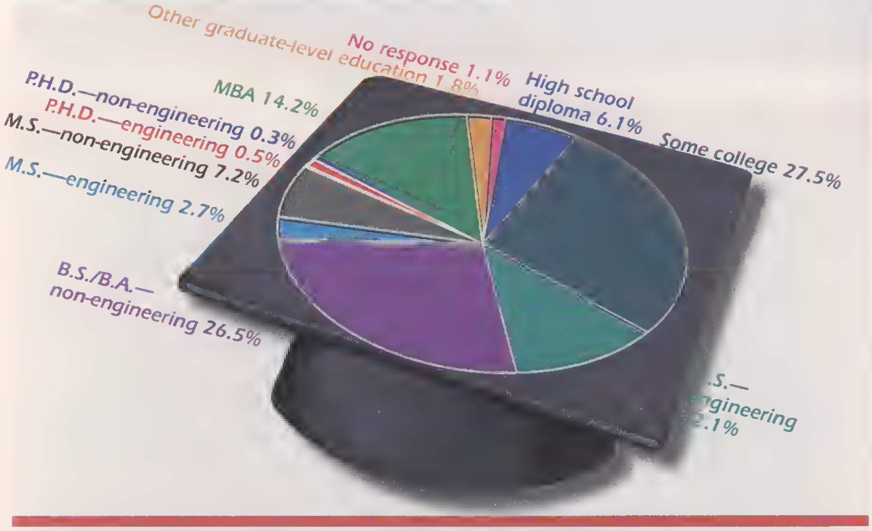


Figure 3.
Highest level of education attained (%)



This year's survey studied salary ranges and supplemental compensation levels, and how those levels are affected by job experience and educational background. The survey was administered, analyzed and authored in conjunction with Jim Bishop, Ph.D., president of Fox River Communications (FRC; Elgin, Ill.) and Daniel Krause, Ph.D., of D.R. Krause & Associates (DRK; Hampshire, Ill.). FRC and DRK administered the survey under *AN's* editorial direction and provided quantitative analysis of the resulting data.

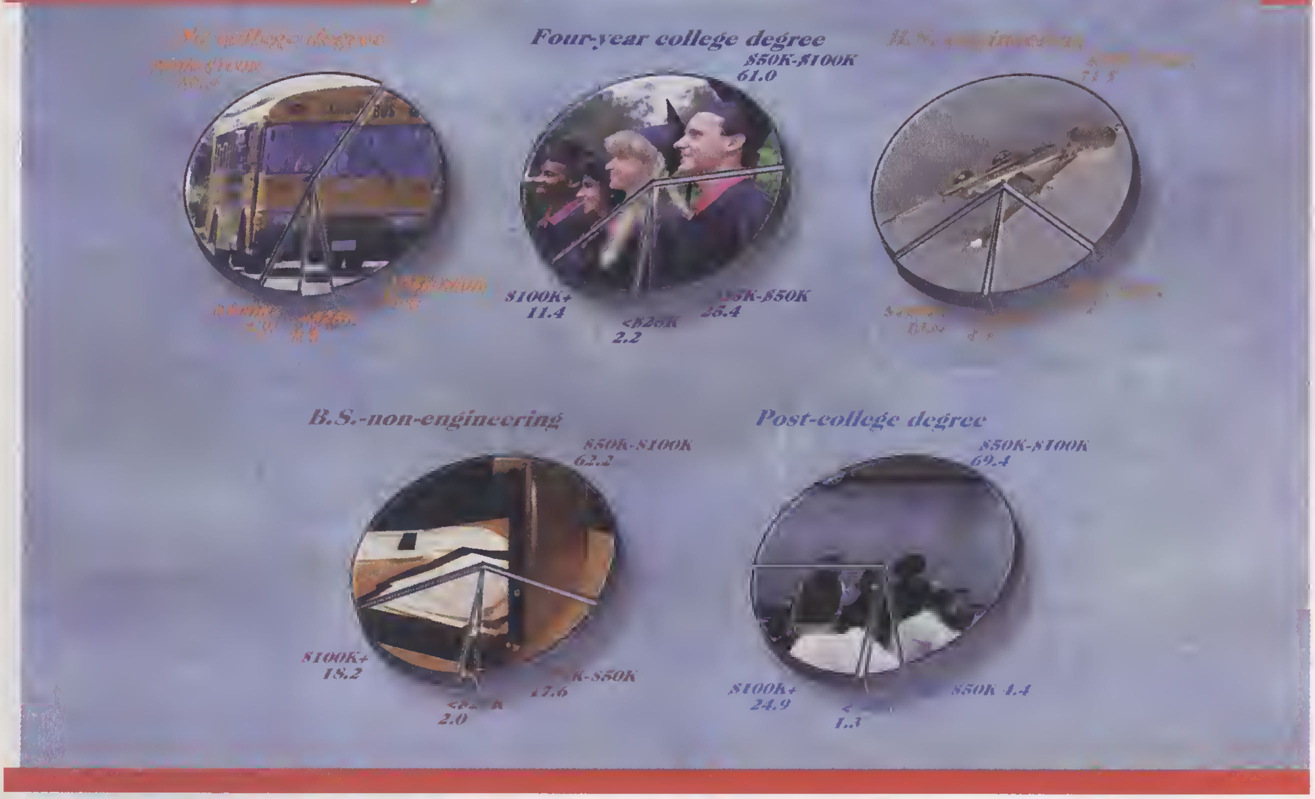
AN's goal was to establish a basis to better understand and interpret salary and bonus ranges within the industry as far as it is represented by the magazine's carrier and service provider readership. More than 7,000 industry professionals were polled (representing about 20% of *AN's* carrier reader segment), including those from incumbent local exchange carriers (ILECs), competitive LECs (CLECs), interexchange carriers (IXCs), wireless service providers, Internet service providers (ISPs), cable TV (CATV) companies, resellers and others. Because job titles in telecom are not standardized, the sur-

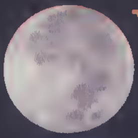
What keeps you UP at night?

Readers bemoan the challenges of surviving in today's telecom industry:

- Keeping up with changes in technology and equipment.
- Competition.
- Too much work, and not enough time.
- How can I get additional training?
- Job security.
- Our company can't focus.
- Constant corporate reorganization and downsizing.
- How to fend off the competition's next move.
- Keeping up with all the paperwork.
- Customer complaints regarding calling cards and Internet access.
- Not enough resources to do the job correctly.
- A domineering boss.
- Continued profitability under new rules.
- Everything!
- Impact of the Internet on our business.
- The workload.
- Finding good quality candidates for wireless positions.
- Retaining good employees in wireless.
- An arbitrary employee appraisal system.
- Low morale.
- Keeping up with the explosive rate of change.
- Bad press.
- Having enough time to get new technology into the network.
- Inexperienced workers and inexperienced customers.
- When SS7 links go down and we have to re-route traffic.
- Decisions made today may be obsolete by the time we implement them.
- Implementing a full-service network.
- More work, less people.
- Premature release of incomplete PCS networks.
- Lack of qualified management candidates.
- Project management processes that are too structured.
- Closing the deal.
- How to motivate my organization.

Figure 4:
How education influences salary





What keeps you UP at night?

- How we will compete in the local services market?
- The thought of going back to college.
- Management's not up to date on technical items. They make a decision based on what a salesman said at lunch or at a golf game—not on what's real.
- Technology! Technology! Technology!
- How to produce high-quality work in a short timeframe.
- With continued downsizing, I'm losing my best employees.
- Having to get the job done with a sometimes-unqualified workforce.
- Managing management.
- There's too much "teamwork" and not enough ownership and accountability.
- How to handle growth with limited resources.
- Everyone's distracted by mergers and acquisitions; we spend more time worrying about organizational moves than the job at hand.

Figure 5:
Salary by job function

Job category	<$25K	$25-$50K	$50-$100K	$100K+
Engineering	1.8	30.9	61.9	2.7
General mgmt.	3.5	15.1	62.8	18.6
Corporate mgmt.	1.2	18.1	39.8	40.9
Data mgmt.	3.8	23.1	61.6	11.5
Finance	—	17.4	60.8	17.4
Technical mgmt.	0.9	23.0	65.0	11.0
Business development	—	19.2	65.4	15.4
Legal/regulatory	—	28.6	57.1	14.3
Personnel/HR	—	50.0	50.0	—
Sales	6.3	17.5	61.9	14.3
other	5.4	33.8	51.4	9.4

Horizontal row percentages do not necessarily total 100 due to some "non-responses."

vey classified respondents in terms of job responsibility—engineering, technical management, finance, for example—rather than by actual title.

More than 86% of the respondents are male. Although the small representation of women in the sample makes it difficult to generalize about gender differences in experience or salary, we can deduce that women still seem to be more heavily concentrated in the personnel, administration, and legal/regulatory areas. Men are more involved in engineering and management.

KEEPING THE PACE

Although respondents report earning relatively comfortable salaries and enjoy fairly stable careers, many are frustrated with the rapid change taking place in the industry and the difficulties in staying abreast of those changes (see the "What Keeps You Up At Night?"). About 17% say their ability to

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- 100 ○ Telecommunications Carrier/Network Service Provider/Holding Co.
- 525 ○ Utility
- 575 ○ Computer Service Firm/Software Developer or Other Computer/Electronic-Related Industries
- 145 ○ Telecommunications Consulting/Engineering Co.
- 135 ○ Construction Contractor
- 152 ○ Telecommunications Equipment Vendor, Reseller, VAR or Distributor
- 500 ○ Finance/Investment/Banking
- 600 ○ Corporate/Private/Government Telecommunications User
- 625 ○ Association
- 400 ○ Other __________ *(please specify)*

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2. Which of the following services does your co. provide? *(Fill in **ALL** that apply.)*

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- B ○ Local Exchange Carrier
- C ○ Cellular Carrier
- D ○ PCS Operator
- E ○ Paging & Message
- F ○ Satellite Communications
- G ○ Other Wireless Operator
- H ○ MSO (Two or more Cable TV Systems)
- I ○ Independent Cable TV System
- J ○ Cable TV Contractor/Engineering Firm
- K ○ Other Cable
- L ○ Competitive Access Provider (CAP)
- M ○ Telecommunications Reseller
- N ○ Internet Service Provider/Commercial Online Service Co.
- O ○ Systems Integration/Outsourcing
- P ○ Other Carrier
- Q ○ OTHER __________ *(please specify)*

3. Which of the following describes your title classification? *(Fill in **ONE** only.)*

- 11 ○ **Technical Mgmt.** (Engineering VP, Director or Mgr.; Technical VP, Director or Mgr.; Network VP, Director or Mgr.; Plant Mgr.)
- 12 ○ **Engineering** (Network Designer, Engineer, Technician)
- 25 ○ **Data Communications/Digital/IS/MIS Mgmt.** (Data Communications, Digital, I/S VP, Director or Mgr.)
- 13 ○ **Mgmt.** (VP, General Mgr., System Mgr., Mgr., Director)
- 3 ○ **Corporate Mgmt.** (Chairman, Owner, President, Partner, Executive/Senior VP/Director, Treasurer, CFO, COO)
- 4 ○ **Legal, Financial, Regulatory or Processing Services** (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
- 5 ○ **Personnel & Administrative Services** (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
- 16 ○ **Sales/Marketing** (Sales or Marketing VP, Director, Mgr., Representative)
- 20 ○ **Purchasing** (Purchasing, Materials, Contract VP, Director or Mgr.)
- 7 ○ **Other** (Co. Copies and Other Titled and Non-Titled Personnel)

4. Which of the follow equipment/services do you purchase, recommend, specify, approve or otherwise influence the purchase of? *(Fill in **ALL** that apply.)*

- A ○ **Wireless/Cellular/Mobile/PCS Equip./Services**
- B ○ **Central Office Equip./Services** (CO Switching Equip. [digital, ATM], Programmable Switches, Operations Support Systems, Workstations, CO Test, Hardware, Frames)
- C ○ **Transmission and Broadband Distribution Equip./Services** (Digital Loop Carriers, Sonet, T1, Microwave, Satellites, Digital Cross Connects, Amplifiers, Passives, Cable, Long Haul Transmission Systems, Loop Distribution and Electronic Systems, Multiplexers)
- D ○ **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
- E ○ **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
- F ○ **Outside Plant and Construction Equip./Services** (Pedestals, Vehicles, Towers, Tools, Enclosures)
- G ○ **Data Communications/MIS/Network Mgmt. Support Equip./Services** (including LANs, WANs, & Network Software)
- H ○ **Power & Protection**
- I ○ **Test & Measurement**
- J ○ **Other** *(please specify)*__________
- K ○ None of the Above (A–J)

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adapt and learn new technologies and issues quickly is critical to ensuring their professional future. But because there seems to be such low turnover, their frustrations balance out with reasonably good working conditions and compensation in an industry that's enjoying a healthy—albeit frenetic—growth rate.

Telecom professionals are doing well these days. Even though about a fourth report earning less than $50,000 a year, more than half of respondents earn between $50,000 and $100,000. A small proportion—roughly 2%—reported base salaries exceeding $200,000. The under-$25,000 salary category was almost negligible in comparison to the other salary ranges. Other findings:

- Readers have a wide variety of job experiences in the field, but also tend to have relatively stable careers, often with the same employer.
- Managers have relatively small management domains; less than 10 people report to them directly or indirectly.
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- An overwhelming majority receive bonus compensation of some sort. The likelihood of receiving a bonus or similar compensation depends principally on length of industry experience. The size of the bonus depends on a combination of the base salary size (higher salary = higher bonus) and educational level.
- Management positions command the highest pay, and straight engineering titles offer the least likelihood of high-level income.
- Salaries also vary by company type; LECs and wireless carriers top the pay scale, with CATV and ISP operations bringing up the rear.

DON'T WORRY, BE HAPPY

AN readers tend to stay with the same company. An overwhelming majority have been in the industry for more than 10 years, and a large percentage claim to have been with their present employer for about the same period. More specifically, 73% have been in telecom for more than a decade, while 10.4% (the second-highest response category) have worked in the industry for six to 10 years. Just over half have worked for the same employer for the last 10 years or more; 17.7% have been with the same employer from one to three years; 13.6% have worked for the same company from three to six years; and 10.3% have stayed from six to 10 years.

This suggests a relatively low rate of mobility across company lines—something that, despite the pace of the industry, could be expected in a sector that has been traditionally monopolistic (low number of carriers serving a region).

Similar, although shorter term stability exists with respect to the specific jobs respondents hold. About half of them have been in their current position for more than three years, and only

company may be a competitor, it also can be a customer.

- Wondering what the boss' boss means when he asks for something silly.
- Educating customers.
- Nothing—I try not to bring it home!
- Customers that won't be satisfied.
- Reading all of the regulations.
- My increased workload.
- Answering e-mail.
- Bandwidth issues.
- TSL and TQL scripts.
- Government intervention.
- What will the FCC do next?

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Figure 5:
Salary by job function

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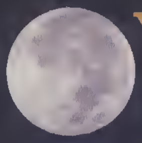

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- With continued downsizing, I'm losing my best employees.
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- Managing management.
- There's too much "teamwork" and not enough ownership and accountability.
- How to handle growth with limited resources.
- Everyone's distracted by mergers and acquisitions; we spend more time worrying about organizational moves than the job at hand.

Figure 6:
Salary by job function and type of carrier/service provider as employer

Job function	Wireline LEC (ILEC/CLEC)	Wireless provider	ISP/CATV company*
Engineering:			
Less than $25K	—	8.3	—
$25K-$50K	36.1	33.3	—
$50K-$100K	61.1	58.3	—
$100K+	2.7	—	—
Corporate Management:			
Less than $25K	—		7.1
$25K-$50K	12.9	28.5	42.9
$50K-$100K	54.8	28.5	28.6
$100K+	32.3	42.8	21.4
Technical/Data Management:			
Less than $25K	—	9.0	7.1
$25K-$50K	15.2	36.3	57.1
$50K-$100K	74.2	45.4	35.7
$100K+	10.6	9.0	—
Customer Service & Sales:			
Less than $25K	—	14.3	—
$25K-$50K	17.2	28.6	—
$50K-$100K	72.4	57.1	—
$100K+	10.3	—	—

*Survey response rates in the engineering and customer service/sales categories were too low to provide an accurate representation of salary ranges within the ISP/CATV areas, in some categories.

adapt and learn new technologies and issues quickly is critical to ensuring their professional future. But because there seems to be such low turnover, their frustrations balance out with reasonably good working conditions and compensation in an industry that's enjoying a healthy—albeit frenetic—growth rate.

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Similar, although shorter term stability exists with respect to the specific jobs respondents hold. About half of them have been in their current position for more than three years, and only

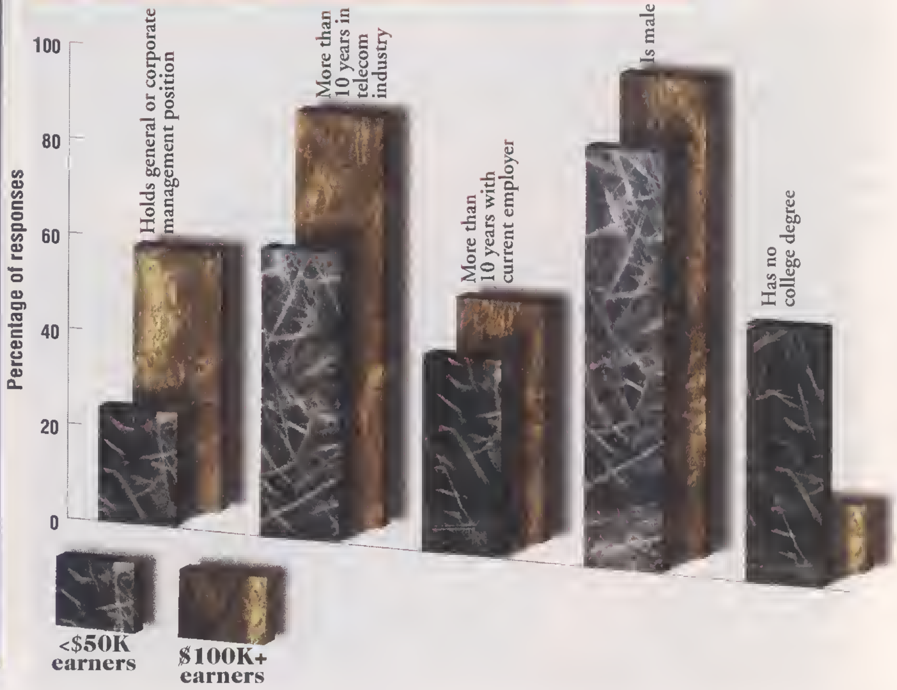
What keeps you UP at night?

- Dealing with management people who, for all intent and purpose, really don't have a clue.
- We need operational support.
- How to satisfy increasingly demanding customers.
- Getting executive support for projects.
- Number portability.
- The future for small telephone companies.
- Routing is always challenging, but dealing with US West makes our life miserable.
- Trying to get departments to reach decisions quickly and accurately in a multivendor operation is becoming next to impossible.
- Formulating sales quotes.
- Deciding which technology to implement that will still be around in five years.
- WindowsNT. All of it.
- Maintaining technical competency in this day and age.
- Trying to convince people that while a company may be a competitor, it also can be a customer.
- Wondering what the boss' boss means when he asks for something silly.
- Educating customers.
- Nothing—I try not to bring it home!
- Customers that won't be satisfied.
- Reading all of the regulations.
- My increased workload.
- Answering e-mail.
- Bandwidth issues.
- TSL and TQL scripts.
- Government intervention.
- What will the FCC do next?

What keeps you UP at night?

- Trying to keep up with technology with a non-technical background.
- What's new this morning is out of date by nightfall!
- Soon, the PCS providers will try and steal the whole pie. Will we be able to outlast them financially, or will they take away our large business customers and cripple us?
- Making sure everyone realizes that what they do every day affects the future of their co-workers.
- How to handle personnel problems without being sued for some minor, frivolous or fabricated reason.
- Customer service and operations support.
- Will the telecom business go the way of the airlines?
- The company's commitment to its employees, and some employees' commitment to their company.
- Creating Web pages.

**Figure 7:
Key differences: high and low incomes**



16% have occupied their present position for less than a year. Nevertheless, many report that they have held several types of positions within the industry during their career, and are proud of it. In fact, a large number of those surveyed indicate that a hybrid technical-business background, or experience with several different technologies, only serves to enhance their personal "marketability."

The finding that management domains are decreasing illustrates the transition of the carrier organization from a hierarchy to one typified by empowered teams and work groups. Only about 8% of respondents have more than 100 workers reporting to them directly or indirectly. More than a half of those surveyed relate that interpersonal and communications skills, and management and team-building traits, are essential to "getting ahead."

EDUCATION VS. EXPERIENCE

In a hyped industry such as telecom, one would expect that a college education would go a long way toward attaining employment and working one's way up the company ladder. Yet, *AN* found that nearly a third of respondents do not have a four-year college degree.

Indeed, the diverse educational backgrounds of those surveyed can account for at least some of the salary differences. However, even though there are some obvious pay differences between college graduates and those not holding four-year degrees, the difference is not substantial between those with engineering degrees and those with degrees in other fields. This implies that on-the-job training may have as much to do with salary success as formal education. Only about 7% listed "education" as a critical factor for success.

The highest proportion of respondents hold a bachelor's degree in a non-engineering field (27%). Only about 15% of the sample hold an engineering degree at the graduate or undergraduate level; however, since the survey asked respondents to indicate their highest level of education attained, results do not take into account engineers who may have gone on to obtain advanced degrees. Roughly 14% of those surveyed said they hold MBAs, and another 10% claimed other master's degrees or doctorate degrees.

Certain types of work experiences may affect earnings. For example, experience in network design, transmission, switching, market development and finance tend to be associated with higher salary levels and, not surprisingly, higher bonus packages. Roughly a third listed specific technical experience as a marketability factor for job advancement, with network and design, and data communications topping the list.

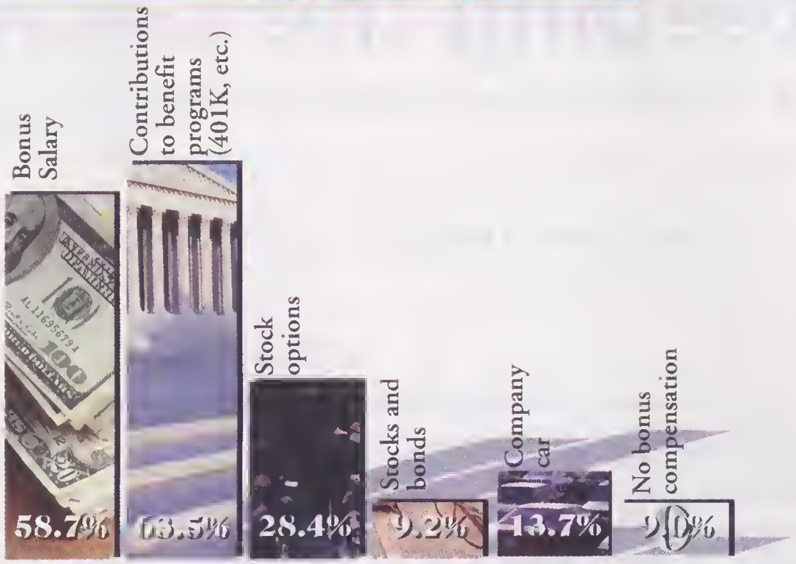
THE DEMOGRAPHICS

Due to the range of positions polled, it's not surprising that salary levels vary considerably by job function and the employing company's primary activity.

Of those earning more than $100,000 or more, 40.9% are in corporate management—no other category comes close. About 15% of those in general management, financial management and business development posts report earning salaries at the upper level. It's apparent that personnel/administration and traditional engineering jobs are not the positions to seek, if high-end salaries are a primary consideration.

Most of the salaries of $100,000 and higher were found in the traditional wireline sectors (LECs and IXCs) and in the wireless industry. ISPs and CATV companies are the least likely sources of high income; ISPs have the largest concentration of low salaries. Those who work for a local exchange carrier

Figure 8:
What kinds of bonus compensation do you receive?



Totals are greater than 100% because of respondents listing compensation under two or more categories.

Figure 9:
Value of supplemental compensation by job category

Job description	<$10K bonus	$10K-$20K bonus	$20K+ bonus
Engineering	60.9	17.3	8.2
General management	41.9	17.4	20.9
Corporate management	26.2	14.3	32.1
Data communications management	57.7	26.9	[illegible].8
Finance	34.8	30.4	17.4
Technical management	44.9	24.3	14.0
Business development	34.6	26.9	23.1
Legal/regulatory	28.6	35.7	28.6
Personnel/HR	70.0	10.0	—
Customer service	42.9	22.2	17.5

What keeps you UP at night?

- The possibility that, despite my best efforts, my company won't survive.
- The sale of the company.
- Nothing! This is a challenging, yet fantastic industry that's a lot of fun to be a part of.
- Micromanagement.
- Nothing. I clear paperwork and new project engineering during work hours. Any construction problem is handled by cellular phone with field workers. Well-written construction plans and well-trained cable crews is the key to making it work.
- Since I own the company, everything occasionally keeps me up.
- The government has such a narrow focus of LECs. It believes there shouldn't be any businesses our size that can be viable.
- Trying to locate a decision maker. The industry is in decision gridlock.

(regional Bell or Independent) or for a PCS provider stand at least a two-thirds chance of making more than $50,000 a year; that chance is reduced to less than half for CATV and ISP workers.

The highest concentration of salary levels in the carrier sector is within the $50,000 to $100,000 range—regardless of company size or other factors. Those respondents reporting the highest (more than $100,000 annually) and lowest (less than $50,000) salaries were considered separately to determine whether differentiating factors existed. (Although it stretches the point to define "less than $50,000" as a "low" annual income, even in today's economy, a lower benchmark in the sample would have been unworkable, due to the small number reporting salaries of less than $25,000.) More than half of those earning less than $50,000 have no college degree, whereas only 13% of high-income earners have not completed college.

It's interesting that smaller companies (less than $10 million in revenue) have higher proportions of employees earning high and low incomes: 34.8% of respondents working for small companies earn less than $50,000 annually, and 20.2% earn more than $100,000 per year. The bulk of respondents working in larger companies (from $10 million to billions in revenue) draw annual salaries within the $50K to $100K range.

BONUSES FOR THE HOUSE

Nearly all—91%—enjoy some kind of supplementary compensation: 63.5% receive employer contributions to benefit plans (such as a 401K match program); 58.7% receive bonus salaries; and 28.4% are awarded stock options.

Those working in business development are most likely to receive bonuses (96.2%); followed by data management (92.3%), engineering (90%), personnel/administration (90%), sales/customer service (88.9%), financial management (87%), general management (86%), legal/regulatory (84.6%) and technical management (84.1%).

Here's where education plays a factor. The survey shows that, clearly, those with an engineering or other college degree are much more likely to receive a larger bonus package (worth more than $20,000 annually) than their colleagues who lack a four-year degree. It's apparent (and fairly common) that those with more experience are likely to receive bonuses. To a lesser extent, the longer one stays in a company, the larger the bonus compensation is likely to be.

Although more than 20% of respondents with less than three years in the business say they're not eligible for bonuses, that number drops sharply (to 13.5%) in the three-to-six-year experience category. Only 9% of respondents with more than 10 years' experience are left out in the cold with respect to bonuses. ■

SPECIAL REPORT

DEBBIE L. SKLAR

Keeping the catch

It's a tough hiring market out there. But there are new ways to recruit and retain the best of the bunch.

HERE'S THE GOOD NEWS: UNEMPLOYMENT IS DOWN. HERE'S THE BAD NEWS: COMPANIES HAVE TO WORK HARDER THAN EVER TO ATTRACT CANDIDATES WHO WILL STAY LONGER THAN JUST THE TWO-WEEK TRAINING PERIOD.

TO WIT: ONE DAY LAST SEPTEMBER, A COMPANY IN CALIFORNIA ANNOUNCED A CORPORATE RESTRUCTURING. THAT SAME DAY, A COMPETITOR'S PLANE BUZZED OVER THE PARKING LOT PULLING A BANNER THAT SAID, "FOR A GOOD JOB CALL, 800 ..."

Integral Training Systems (ITS; Mission Bay, Calif.) reports that today's managers routinely receive two calls a month from executive recruiters—that's 24 overtures a year. How can companies stop the "poachers" and keep their best employees?

"Retention of talented staff has not received a high priority from companies and managers," says B. Lynn Ware, ITS president. "During the years when corporate restructuring and downsizing was dominant, companies were more concerned with shrinking their staff. Now, with chronic shortages of employees with high-demand skills, companies are ... facing the dilemma of how to retain."

Research shows that one of the key variables in retaining top employees is not salary packages, bonuses or other financial incentives, but managerial skill. "Our research shows that managers can learn skills that will boost retention of key employees," says Bruce Fern, a retention expert who works with ITS.

Although some managers believe that an employee's career goals are personal concerns, and that providing them with development skills only makes them ripe for recruitment by another company, research, in fact, shows the opposite. "A manager's interest and concern in the employee's development tends to bind the employee closer to the company, and retards turnover rather than increasing it," Ware says.

Three ways to boost retention

- Is there trouble on your team? Knowing how to clear it up will boost retention.
- When you recruited a valued employee, were you completely honest about the 'bad part' of the job? Telling the truth can boost retention.
- Do you know what your key employee's long-term career goals are? Can you steer them to assignments or education that will help them develop their futures? These are only a few steps that can boost retention.

Source: ITS

THE ATTRITION DILEMMA

Top performers innovate and provide services that can differentiate a company from the competition. Corporations rely on their human assets to survive and thrive. But with unemployment running at less than 6%, many corporations and government agencies struggle to find and keep valuable workers. Changing work force demographics—such as the shrinking of the most desirable labor pool (the 25–34 age group)—and the negative impact downsizing has had on employee loyalty leads companies to search for ways to retain their most strategic assets.

"The old contract asked employers to work hard, be loyal and give their all," Ware says. "In return, they would have a job for life, a home away from home, regular salary increases and a

> **Retention practices focus on what the employee is contributing, but also ... how the manager can create a climate so the employee is committed.**—*B. Lynn Ware*

Our job market is tighter and the cost of living is high. It's a situation where the talent pool that exists for the amount of entry-level salary we can afford creates real barriers—*Peter Eder*

good chance for a promotion."

That "contract" is different today. "Employees must now work harder, doing not only those jobs, but the jobs of their former co-workers who were 'rightsized,' " Ware says. "In return, job security is extinct, promotions are scarce, salary increases are modest at best and the constant uncertainty of change is almost guaranteed. Is it any wonder that employee loyalty is on the demise, and talented contributors and managers feel any less bonded to their organizations?"

Yet, why employees stay with a company is not the same as why they leave—a fact that escapes many employers. "Many [companies] attempt to capture the causes of attrition through standard exit interviews," Ware explains. "Unfortunately, traditional exit interviews just scratch the surface; they inevitably fail to differentiate between factors that make the new job attractive to the departing employee, vs. the reasons why the employee was prompted to consider leaving the job in the first place."

One way to stem the tide is to educate the managers. "Most organizations ask their managers to place productivity as the highest priority ... to fill 'our obligations to our investors,' " Ware says. "Good retention practices focus not only on what the employee is contributing to the company, but also ... on how the manager can create a climate so that the employee is ... committed on a long-term basis."

RECRUITING KEY PEOPLE

Peter Eder, vice president of client services at Wahlstrom & Co. (Stamford, Conn.), offers insight on recruitment practices. Some of Eder's clients include AT&T and Lucent Technologies.

"In addition to the traditional ways of running ads in local and area newspapers, [and] having an employee referral program, we try to use a college intern program as a source for new hires," Eder says. "By assigning more than routine tasks, we expose our interns to the workings of the agency and, at the same time, can measure their interests and contributions."

Yet, trying to find quality people is becoming more difficult with each passing year. "In our area, the job market is tighter and the cost of living is very high," Eder notes. "It creates a situation where the talent pool that exists for the amount of entry-level salary we can afford creates real barriers. College graduates also have higher earning expectations these days. It seems to be a return to the early '80s."

What keeps you UP at night?

- Trying to do a job or project with my "tight-a**" boss not sending me to any seminars, classes or meetings.
- Personnel issues.
- The future of the Universal Service Fund.
- Inferior computer programs that require work-arounds.
- Time limits to respond to requests for hi-cap, ISDN, etc.
- There never seems to be enough time.
- All of the multifaceted issues that could cripple a startup like ours.
- Too many customers to juggle at once. Everyone wants proposals immediately.
- Cable cuts.
- DMX to IS-41 conversions.

Qualities to look for? Good oral and written communications skills. "Written communications skills seem to be in short supply," Eder says. "In addition, we look for people who have had some

What goes down can come up

AT&T certainly made a big splash (or a big thud) when two years ago it announced tens of thousands of job cuts. Since then, the Basking Ridge, N.J.-based giant has actually increased its ranks—to 133,000 from 128,000 two years ago.

"People were saying that all AT&T could do was subtract, but what they also failed to remember is that a big company can subtract and add, too," says Burke Stinson, AT&T spokesman. "True, our recruiting at college campuses has decreased from between 500 to 1,000 this year, but we have been looking for people off the street. We look for experienced people in some of the faster growing fields of the industry. Now we're looking for people in cellular or wireless, because we expect to double the work force in these areas by the turn of century."

AT&T conducts interviews mostly online—and typically for people who display computer science skills, Stinson says. "We also go toward the other end of spectrum, where we recruit people who have 'human' skills. We're expanding and doubling our efforts in our customer service arena."

The company looks for candidates with important scholastic achievements, and a willingness to keep learning. "We spend billions on training and educating," Stinson says. "We would like to hire and retain, and promote those we train. We want people that are able to assess what's going on quickly and remain courteous. It's important that they will be able to provide the correct information and essentially guard the AT&T image with our customers. It's not always easy."

Although it may be easy finding people, keeping them is another matter. "We must process 100,000 resumes a year, and half of our work force is managerial," Stinson says. "I think one of the ways we have been able to keep our employees is the fact that we offer them such a flexible schedule. Half of our managers regularly work at home—that's a high percentage. We allow people to work the hours most convenient to them. Giving them a flexible work schedule is a way to gain their appreciation."

Because of these programs, Stinson believes AT&T employees think twice about moving to another company. "We also tend to pay higher than the normal workplace environment," he says. "When it comes down to comparing their options, most weigh them and stay with us."

> **When looking for leaders, companies will take a chance on an unknown who, has accomplished a strategy, rather than the internal candidate who knows the business.**—*Steven Schrenzel*

work experience as interns or may have taken some time off from school to work. Also, people who can focus, can handle detail, and can be patient and curious. A Phi Beta Kappa key is also a plus, since it reflects a view on the individual's learning abilities."

Once they're reeled in, Wahlstrom keeps them by providing constant challenge—so they won't get bored, Eder says.

SKIPPING TO THE TOP

Many of today's telecom executives worked their way up from entry-level positions; but can new hires expect the same opportunity? Anything is possible, but it's a lot more difficult, Eder says. Today's focus is on specialization, not general skills. Moreover, the social contract between employees and employers no longer exists. "Employees have little loyalty to a company; they are conditioned to look at their firms as stepping stones along a path," he notes. On the other hand, employers no longer make long-term commitments to employees; indeed, most consider resizing, downsizing, outsourcing, or hiring part-timers.

"Also, employees look at the CEO, and very often see someone who is also not a long-term employee but a person who has skipped his or her way to the top," Eder says. "The best way to get from the technician to the CEO in 10 years is to invent a unique elevator that can obsolete the ladder, and then beat or buy out the company. Entrepreneurship is a large element to rapid success."

Steven Schrenzel, managing director of The Governance Group Inc. (Summit, N.J.) an executive resource consultancy, says becoming a future CEO requires careful navigation. "Typically, when looking for leaders, companies are more willing to take a chance on an unknown who, in theory, has been successful in accomplishing a particular strategy, rather than consider the internal candidate who knows the business," he says.

PERFORMERS AND VETERANS

There are two search approaches companies can consider: the 'been there, done that' candidate that can move into the job today; and the best available "athlete" who can perform over the long term. "In technical jobs when the search is on for a manager, companies look for a hands-on-manager," Schrenzel says. "This is a manager who doesn't just roll back his sleeves, but knows what work is being done and participates in the work as a player-coach."

Schrenzel looks for people who are acutely aware of their reasoning and decision-making style. "Managerial jobs need highly inductive reasoning [skills]," he says. "Deductive and analytical reasoning is needed for technical jobs. I would argue that the most successful people are [those] that can switch between decision-making styles, and can move from deductive to inductive reasoning appropriately. I also look for someone who believes in building consensus and who is not afraid of taking calculated risks."

Even though a sizable percentage of industry professionals do not carry four-year college degrees (see page 19), most of Schrenzel's clients are requiring them. "Honestly, for most of the senior professional and tech positions, our clients insist on a bachelor's and/or a master's degree—although we do try to get our clients to look at the level of experience the person may have if they don't have a degree," he says.

"Many people don't have a degree, yet they're working in engineering-titled jobs," Schrenzel continues. "Some have had government or military positions, but a lot of them have just had training at various [regional Bell operating companies]."

What keeps you UP at night?

- Switch conversions.
- Selecting the correct corporate strategy and appropriate technical options to support that strategy.
- Software bugs.
- Evening college courses!
- The whole environment is changing, and there are no clear answers on what it will look like in five years.
- Nothing. The separation of work time and free time is important, so you can be fresh.
- Continuing to do more with less in a high-growth (8%-10%) area.
- How to reduce fraud and customer churn.
- How can I, with a technical background, advance in a company which is enamored with marketing types?
- Lack of communication from upper management.

Employers should not overlook the mature work force. "One major problem in recruiting is that people want the young, up-and-coming professional and manager," Schrenzel says. "In many cases, they tend to overlook the more mature, experienced leader/manager. I would argue that maturity in the technical field adds a lot of value. We look for business maturity, regardless of age."

KEEPING THE CATCH

The answer to the current recruitment problem in telecommunications is retention management, Schrenzel says. Here, employees fall into three categories: "absolutely delighted," "satisfied" and "I hate this place."

"In a typical organization, employee attitudes follow a bell-shaped curve," he says. "Five to 15 percent fall into either extreme, and 70% to 90% are in the 'satisfied' scale. You're not going to lose the delighted employee; you lose the 'I hate this place' employee and his friends, and the satisfied people who are the ones influenced by those disgruntled colleagues.

"With a little time and money, you can actually measure what it is about your workplace that people value most," Schrenzel says. Try to put a cost to it, he says, and determine the effective-

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Circle 109

What keeps you UP at night?

- How to fit job demands into an eight-hour day, because the budget does not allow any overtime. If you can't get your work done, it's up to you to figure it out on your own time.
- Pressure to deliver.
- Convincing the company to invest in the correct technologies.
- Take rates.
- Irrational business decisions made by the competition that affect the industry as a whole.
- Nothing. (So far, so good!)
- Dealing with massive changes in the technologies we're deploying, while maintaining service at levels that meet or exceed expectations.
- Keeping a focus on the long-term strategy as we work through the day-to-day problems.

ness of emphasizing attributes that people value.

By reducing the number of dissatisfied employees, a company can dramatically impact the people that are in danger of leaving, Schrenzel says.

A key issue: technical employees are inherently curious and need to be intellectually challenged. "They want to know what the next challenge is going to be because they want to look forward to it," Schrenzel says. "They also want to be included in decision-making, and they want to know what's going on in the organization."

Usually, the more communication, the better. "Mostly, they want something most employers can't give—assurance of security," Schrenzel adds.

According to Schrenzel, employee dissatisfaction factors fall under three categories:

- They don't understand their pay scale and corporate compensation system;
- Inconsistency in workplace culture (feeling like they've moved to another planet when all they did was move to another department); and
- Perhaps the surprising fact that not all technical people want to move into management positions. Those who do want assurance that opportunity is there.

There's not enough promotions to go around. That's not to say someone can't become CEO, but it's just more difficult than it once was.—*Amy Damianakes*

They want to be trained on management and leadership skills—and if no training is available, they'll get dissatisfied.

CONSISTENCY AND THE CLIMB

Jimmy Webster, senior manager of technical recruiting for MCI (Richardson, Texas) says staying with the same company for a number of years helps make the "climb" a lot easier. "There are definitely advantages in staying with one corporation over several years due to knowledge of the culture, history, vision [and] industry," he says.

MCI initiates searches by first posting the openings internally. "If we do not have an internal qualified and available candidate, then we begin our external search," Webster says. "For experienced candidates, the referral program is our largest single source.

"Other sources include Internet advertising, job fairs and military outplacement. In addition, we hire recent college graduates," he says.

Trying to retain employees is one of the biggest problems large companies such as MCI face daily. "It's about supply and demand," Webster says. "Technically qualified individuals are in such demand that traditional recruiting sources, like newspaper ads, are not as effective as in the past. Web recruiting has become essential." MCI mainly looks for technically qualified individuals—telecommunications engineers, IT professionals and technicians.

"Business requirements change so quickly that individuals must be flexible," Webster notes.

AirTouch (San Francisco) also utilizes the Internet to attract potential recruits, according to spokeswoman Amy Damianakes. "We use a variety of methods like posting on our Web site to target our recruits. We're also an active member of the Global Wireless Education Consortium [GWEC], and we do traditional recruiting, like posting ads. It depends on the kind of candidate we're looking for."

Ameritech (Chicago) recruits employees through a customized database that houses thousands of resumes and candidate information. "We are finding that this data is extremely valuable in today's market where candidates change jobs with increasing frequency," says Judy Raica, director of human resources. The RBOC also uses search firms, and has a program that rewards Ameritech employees for successful referrals.

To keep the cream of the crop rather than having it skimmed off, AirTouch offers managerial and higher level employees part-ownership in the company, using stock options and a discount stock purchasing program. "We also spend a lot of time surveying our employees to find out how we can improve in areas," Damianakes says.

"We recently instituted major changes to the compensation program to provide flexibility and latitude in pay ranges," Ameritech's Raica adds.

FALLING LADDERS?

Here's some more bad news: it's becoming harder to climb the corporate ladder. Can employees work their way to a senior-level management position? No—or, at least not at AirTouch, Damianakes says.

"We're trying to have matrix-style management," she says. "Simply, there's not enough promotions to go around these days. That's not to say someone can't become CEO eventually, but it's just more difficult than it once was."

Tell that to Richard C. Notebaert, who joined Wisconsin Bell as an entry-level employee in 1969 and who now is CEO of Ameritech (Chicago).

"Ameritech has a strong history of career pathing," notes Raica. "For those willing to accept change and learn new things, anything is possible." ■

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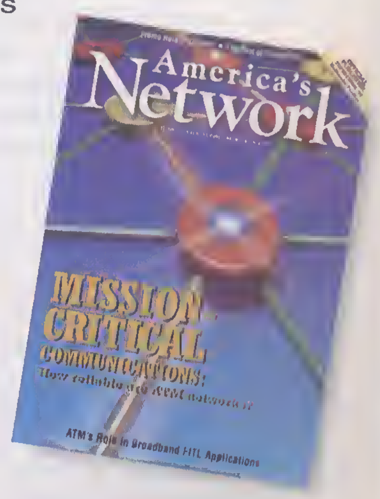
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MISSION CRITICAL COMMUNICATIONS:
ATM's Role in Broadband FITL Applications

SHIRA LEVINE

The steel behind the sparkle

If they want their splashy new services to succeed, carriers must add employee training to their 1998 budgets.

FASTER SPEEDS, GLITZY WEB SITES, ENHANCED SERVICES, MORE INTERACTIVITY—ITEMS ON MANY WISH LISTS THIS HOLIDAY SEASON.

But as any parent—or service provider—can attest, everything comes with a price tag: the cost of upgrading the network, and the cost of upgrading the skills of those who operate it.

"The single greatest challenge for senior management is to identify and retain skilled technical professionals who are in step with the most recent equipment and software releases," says Dan Veitkus, director of learning services at Bellcore (Lisle, Ill.).

Consumer demand for new services has turned the heat on for service providers to deliver technologies such as ISDN, digital subscriber line, cable modems and wireless. The trick, Veitkus says, is in staffing these new operations, either by bringing the existing workforce up to speed or stealing employees from the competition.

"The qualified applicant pool is relatively small, and cannibalization of the competition's workforce is prevalent," Veitkus says. "Service providers are actively pursuing the most skilled and highly trained individuals."

"We recruit heavily from technical schools, but there are also lots of folks that we bring in from competitors," says Dallas LeDuff, director in human resources at BellSouth (Atlanta). "We get experienced people from cable companies or smaller telephone companies who want to work for a larger one."

Given the supply-to-demand ratio of skilled applicants, however, most carriers usually set their sights lower. "[Service providers] have stepped up their work in the area of recruiting people out of college or technical school," Veitkus says. "There's also quite a migration from other types of businesses, folks who may have been laid off mid-career in another industry and who migrated to the fastest-growing industry—telecommunications. We're training more folks from that sector, or who have been recruited from a competitor, than we are new graduates."

OUTSOURCED TRAINING

All new employees, regardless of where they're from, need some degree of training. Add that to the fact that many service providers are cutting back on their in-house training programs, and the result is a huge business boom for outside training companies.

"There are very few educational programs in place within companies anymore," Veitkus says. "Many companies are focusing on their core competencies, and those core competencies are not training and education. That's one of the first things to be outsourced."

As service providers struggle to meet consumer demand for high-speed data services, training companies see that reality reflected in demand for their courses. Joe Aiken, president of ABC Teletraining (Geneva, Ill.), says there has been a rush on training courses on ISDN and digital subscriber line technology. In fact, Aiken sees the Internet as having a considerable effect on technical training.

"I think telephone people are going to have to get more familiar with data-type communications, because they need to learn about what is being transmitted over their wires," Aiken says. "On the other hand, the data people need to learn more about the telephone business because they're getting into it through the Internet."

But the surge of interest in the Internet and other remote networks opens a whole new can of worms. As businesses hook their internal networks into the Internet and provide access to remote employees, they run the risk of letting some unwelcome intruders in. "There's a tremendous amount of hacking going on out there—it's the hobby of the '90s," says Rich Kristof, vice president of business development at Global Knowledge Network (Waltham, Mass.). The result is that network security training courses are "the hottest thing we've got," he says.

As service providers try to design and manage their networks more efficiently, Global Knowledge Network is seeing a demand for courses in network design, troubleshooting—particularly TCP/IP—and network management.

TECHNICIAN TRADES

Training demand also reflects service providers' push into new markets. "We see utilities, telcos, cable companies all going into different businesses, and they need to train their employees to work in those areas," says Greg Bhuta, manager of technical training development for ADC Telecommunications (Minneapolis).

Wireless training tops the "wanted" list, as service providers staff their new wireless operations by shifting their landline technicians to the wireless side. "A lot of folks are migrating from 20 years with a wireline job to a wireless position," Bellcore's Veitkus says. "These folks need a general overview of what's going on in the wireless industry, public policy issues that are impacting the delivery of services, [and] emerging technologies for wireless providers and standards." Other hot wireless training issues include wireless number portability, wireless 911 and high speed data, he adds.

Similarly, Scientific-Atlanta is seeing demand for digital training as many cable operators shift their analog technicians to their new digital services—a transition that often is difficult to pull off, says Mark Enter, director of marketing and education for worldwide services at Scientific-Atlanta (Atlanta).

"When a cable operator migrates from analog to digital, it's really tough on some of the analog technicians to come up to speed," Enter says. "It's a shift from a box mentality to a systems mentality, and we see training as being so critical to the migration from maintaining boxes to some very complicated digital-based systems."

Perhaps most telling of the shifts within the service provider community is the fact that demand for basic training is greater than ever. "There's a definite need for training in basic components of service delivery, such as T1 or DS3," ADC's Bhuta says. "The industry tends to focus on splashy things like ATM and Sonet and hybrid fiber/coax, and forget that the core of the network are things like those, that technicians and engineers get into on a regular basis."

In the past, these telephony basics would have been taught to newcomers by some of the old hands at the company. But as service providers tighten their belts and streamline their workforce with early retirement packages, those old hands aren't necessarily there anymore. "Too many people are being retired early, so there's no one to train the new people coming along," Aiken says.

BAD CORNER TO CUT

Many companies opt to replace informal training with more structured courses, but in doing so run the risk of eliminating a hands-on approach. Scientific-Atlanta and Global Knowledge Network, among others, are trying to reverse that trend by providing interactive, hands-on training in a lab environment.

"When someone goes back to his work environment, he doesn't have the instructor over his shoulder," Kristof says. "With hands-on training, if he improperly plugs in a piece of equipment and doesn't hear the 'pop' that he felt in class, then he knows he's done something wrong."

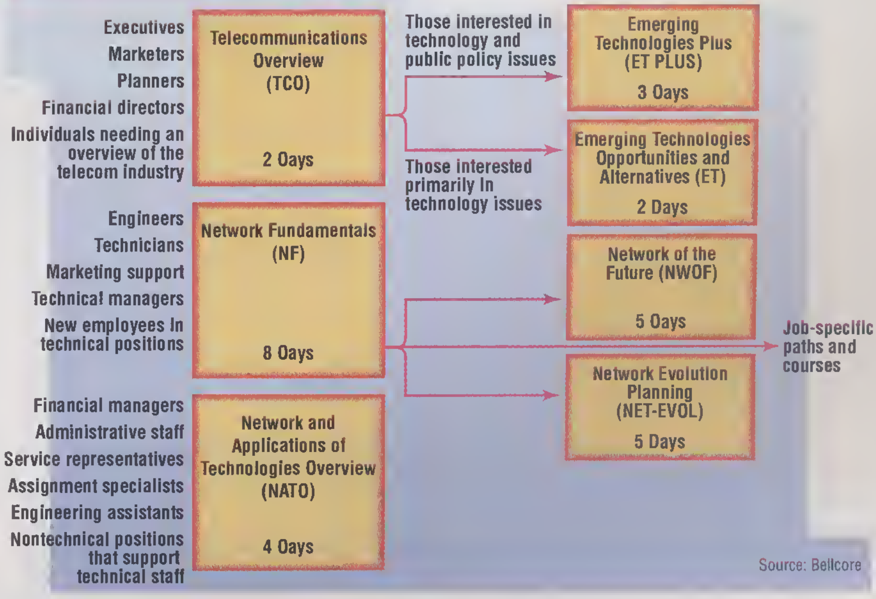
Many service providers choose to bring training programs to their employees on their own campuses.. "Companies don't want their employees going away for training," Veitkus says. "They want them to stay on site, and they want the topics customized and suitcased to their individual needs to try and make the most of that training time."

Whatever works—as long as the service provider keeps training on the front burner. "When training lags, operators have problems bringing systems up to peak operation, and it takes longer to maintain them," Enter says. "With some of the newer systems, performance is critical—revenues depend on it. Those guys have to be able to get the systems up fast and keep them up, and they can't do that without adequate and appropriate training." ■

What keeps you UP at night?

- How to establish my company's products as "unique."
- Impending relocation.
- Being spread too thin.
- Outsourcing.
- I'm too exhausted to stay up at night.
- Getting enough capital to grow the business and get the job done.
- It's very difficult to get employees trained before the product becomes available to customers.
- Have we done everything to ensure network availability around the clock?
- Frequency planning and troubleshooting in an expanded, yet mature, RF environment.
- Finding qualified employees.
- The changes are coming too fast. I can't keep up.
- Now that we built it, what do we hook up to it so we can make money?
- I sleep fine, thanks.

Telecommunications fundamentals training paths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Those interested in technology and public policy issues
Emerging Technologies Plus (ET PLUS)
3 Days
Those interested primarily in technology issues
Emerging Technologies Opportunities and Alternatives (ET)
2 Days
Engineers
Technicians
Marketing support
Technical managers
New employees in technical positions
Network Fundamentals (NF)
8 Days
Network of the Future (NWOF)
5 Days
Network Evolution Planning (NET-EVOL)
5 Days
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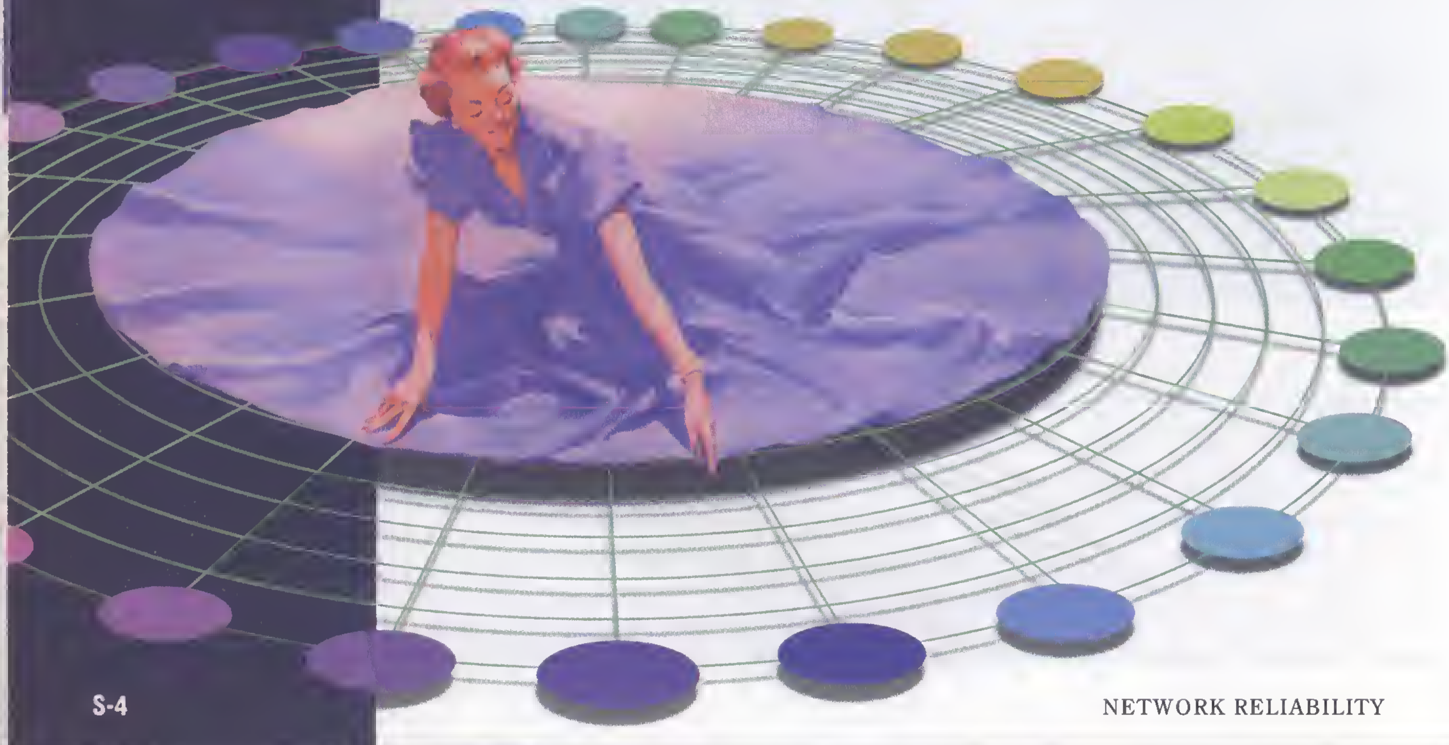
As carriers and service providers—all with varying degrees of network sophistication and financial backing—interconnect to form the new public network, reliability standards must be maintained across a wider range of systems than ever before. Incumbent local exchange carriers (ILECs), competitive carriers, CATV operators, wireless companies and Internet service providers (ISPs) must be able to cooperate on reliability and efficiency issues as well as they compete on price and service levels.

How does the industry accomplish the interconnection mandate and, at the same time, keep the network reliable?

Chapter Two of our five-part series, The Health and Safety of the Public Network, delves into **"The Interconnection Nightmare."** In this special section, we will analyze the current processes and techniques of interconnection, discuss how standardization may solve interconnection woes, and provide suggestions for network testing and management. (Chapter One, "The Network Reliability Roundtable," was featured in *AN*'s Nov. 15, 1997, issue. The series continues through March 1998.)



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THE QUESTION OF INTERCONNECTION: Three Unholy Scenarios and One Holistic Solution

Ways to avoid throwing the reliability baby out with the regulatory bathwater.

By Bob Wohlford
Assistant vice president for network business development at Nortel (Research Triangle Park, N.C.)

There is little doubt that Americans enjoy the most reliable telecommunications service in the world. But thanks to the Telecommunications Act of 1996, that world is changing. Many in the industry fear that, in the rush to competition, network reliability may suffer.

The Telecommunications Act of 1996 requires incumbent local exchange carriers (ILECs) to allow other providers to interconnect into ILEC networks. Specifically, Sec. 251(c)(3) of the Communications Act of 1934, as added by the 1996 Act, requires ILECs "to provide, to any requesting telecommunications carriers for the provision of a telecommunications service, non-discriminatory access to network elements on an unbundled basis at any technically feasible point on rates, terms and conditions that are just, reasonable and non-discriminatory."

Up to this point, issues of network reliability have been addressed by the set of practices defined by Bellcore. (Before 1984, these practices were dictated by the Bell System.) Neither the Federal Communications Commission (FCC) nor the courts have dictated that new entrants adhere to the Bellcore practices, however. Now that the rules that have ensured network reliability for generations have been set aside, the question is this: What will take their place?

In this new, interconnected world, the FCC has ordered that each network operator has the obligation not to harm the public network. Unfortunately, the standards for determining service-quality degradation are extremely vague, and ILECs are required to provide any type of interconnection that is "technically feasible." What's more, no group has been designated to define standards of acceptable quality of service (QoS), or to determine how faults will be isolated and responsibility determined when the inevitable disputes arise between service providers.

Nortel and other vendors support and participate in such organizations as the Network Reliability and Interoperability Council (NRIC) and the Alliance for Telecommunications Industry Solutions (ATIS; Washington). These groups are doing important work and their roles should be expanded. But ATIS and the NRIC are advisory in nature; moreover, regulations that govern service quality and network operations have been struck down, and are unlikely to return.

continued on page S-8

INDUSTRY'S TOP SECURITY CONCERNS

- Increased number of access points and networking.
- Co-location of carriers into one carrier's infrastructure basket(s).
- Increased number of interconnected (and inexperienced) systems administrators and processes.
- Embedded operations channels of signaling and transport protocols (such as Sonet DCC, ATM OAM cells and SS7 network management messages) gives virtually unlimited access to everything and everyone connected/networked to them.
- Internet and intranet exploitable technology is used for access to public network operations and signaling systems.
- Local number portability adds complexity, dependencies and single points of failure.
- Lack of fidelity bonds; criminal background checks.
- CALEA Control Requirements of Sec. 229 of the Telecommunications Act.

Source: NRIC FG1 Operations Task Group

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There is a danger that a very important baby—network reliability—may be thrown out with the bathwater of regulation. Following are three scenarios for what could occur as a result of network interconnection among not only competing local exchange carriers, but also Internet service providers (ISPs), wireless carriers, competitive access providers and other new entrants.

SCENARIO 1:
A Signaling Network Disaster

Perhaps the greatest potential for a disaster scenario lies in the signaling network. The technical feasibility of large-scale outages which originate in the Signaling System 7 (SS7) network certainly has been demonstrated adequately enough to make this an area of concern for everyone who's been paying attention.

Signaling networks are very fragile. What's worse, just a few of them carry virtually all of the traffic. Any significant problem in the SS7 network has the capability to create catastrophic outages in the voice network it supports.

The Telecom Act removes any requirement to follow the existing gateway arrangement between signal transfer points (STPs). Under the previous arrangement, these gateways performed the function of regulating and authenticating traffic coming into an STP from any service provider's central office (CO). Now, that traffic goes directly from CO to STP, and the potential exists that the STP could be flooded with SS7 traffic, through a technical glitch, human error or breach of security in a provider's network.

Because SS7 does not check authenticity of origin, these problems are going to be exacerbated by the fact that the ability to purchase signal control points (SCPs) may be cost-prohibitive for some new, entrepreneurial network entrants.

The advent of local number portability (LNP) increases the likelihood of a domino-effect disaster in the signaling network. As the ownership and control of numbering databases start to proliferate, the potential risk from either a hacker or mere human error goes up

> No group has been designated to define standards of acceptable quality of service, or to determine how faults will be isolated and responsibility determined when the inevitable disputes arise between providers.

accordingly.

Admittedly, this disaster scenario may be alarmist. More conservative observers will point out that, according to Bellcore, only 972 outages have been reported since the FCC established the service incident database in 1992, and that cable cuts remain the leading cause of such network outages. But the world is changing, and large-scale problems in the signaling network are certainly within the realm of possibility.

SCENARIO 2:
Quality of Service Seeks the Lowest Common Denominator

A second scenario stems from trunk interconnection. Based on the legislation and FCC order, ILECs must provide trunks to the CO facilities of competitive service providers. Certainly, this meets the test of being "technically feasible"—non-competing operators within the same local access and transport area (LATA) have been using this arrangement for many years now.

However, there are several important differences between these existing trunk interconnections and those that are being established between competing companies.

The ILECs have almost universally maintained their networks in accordance with Bellcore practices. These practices addressed all issues of network reliability, virtually guaranteeing that interconnections between two local exchange carriers that adhere to the standards would not degrade service to subscribers of either operator.

With the Bellcore practices now completely voluntary, trunk interconnections will not go necessarily "by the book." One mundane, although potentially troubling problem is the issue of nomenclature. When two network operators do not share the same designation for the same facility, isolating and clearing faults will become much more difficult.

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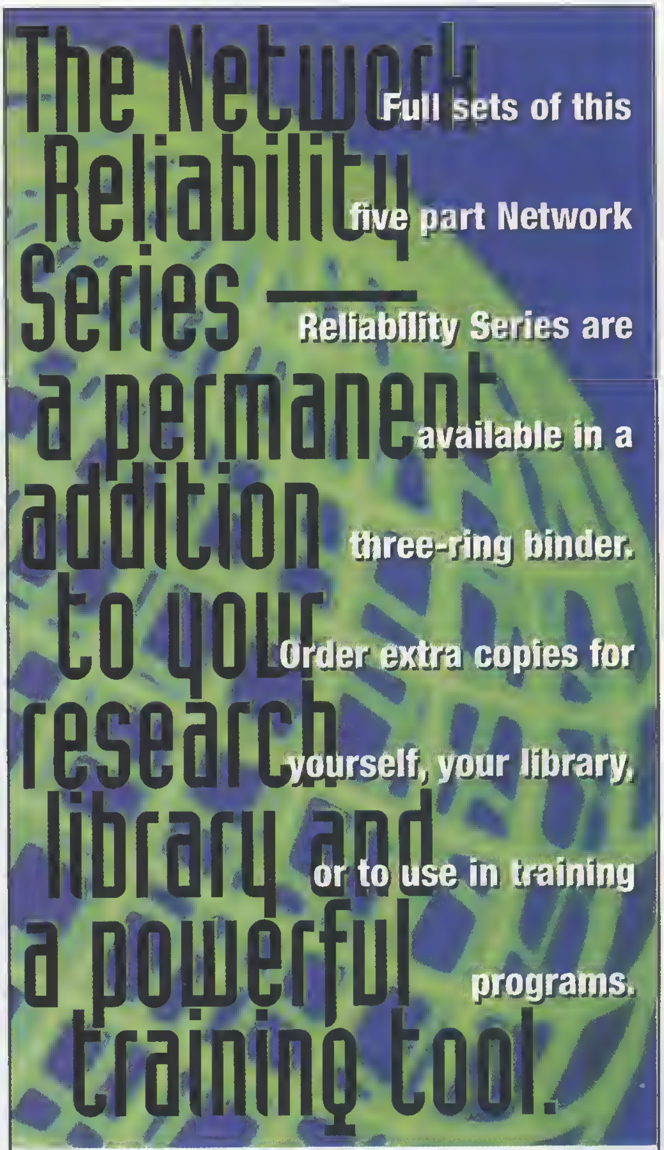

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The current method of unbundling is to provide jumpers from the main distribution points to deliver copper distribution points to a competitive carrier. This is a manual procedure, prone to errors as simple as moving line-pair termination to the wrong service provider.

Beyond nomenclature lies the question of jurisdiction. If a fault occurs, affecting service quality in both interconnected networks, the responsible party will not be easily or clearly defined in every instance. This is a scenario for quite a bit of finger-pointing between competing companies—with the subscribers suffering for it.

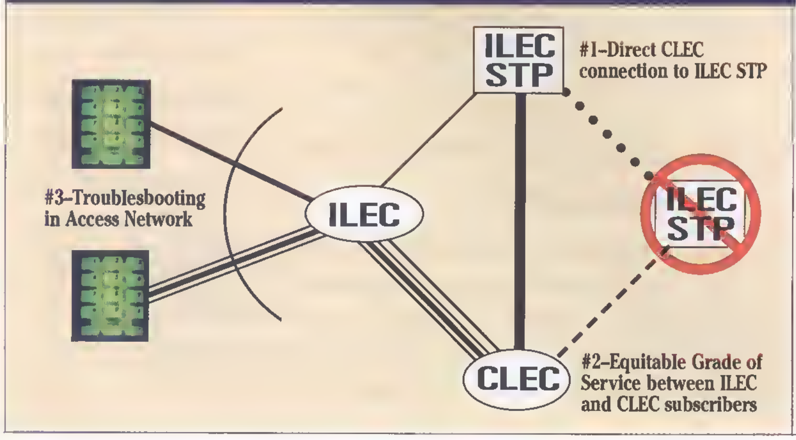
Unfortunately, the wording of the FCC order leaves the door open to just such a scenario. For competing local exchange carriers with interconnected facilities, the only requirement is that equal service quality must be maintained for subscribers of each network operator. This does not take into account the very real possibility that different providers may establish different standards of quality. In theory, the marketplace will sort this out organically, as subscribers move from low-quality to high-quality carriers. However, in an interconnected network in which measurements of service quality may become very subjective, overall quality could be degraded for all subscribers without violating the requirements of the FCC order.

SCENARIO 3:

Who's Watching the Outside Plant?

Instead of a disaster scenario, the real danger of network unbundling lies in a gradual and almost undetectable degradation that could take place in the outside plant. As loops become unbundled, the integrity of the outside plant is put at risk in a number of ways.

Three points of possible reliability issues in interconnected network


ILEC STP
#1-Direct CLEC connection to ILEC STP
#3-Troublesbooting in Access Network
ILEC
ILEC STP
CLEC
#2-Equitable Grade of Service between ILEC and CLEC subscribers

For example, the current method of unbundling is to provide jumpers from the main distribution points in order to deliver copper distribution points to a competitive carrier. This is a manual procedure—prone to errors as simple as moving line-pair termination to the wrong service provider. The industry needs to search for alternatives to this physical unbundling process.

By design, competitive providers are likely to be more aggressive in deploying advanced technologies, such as asymmetrical digital subscriber line (ADSL). This certainly is a positive step, and one of the intended consequences of last year's legislation. However, introducing higher power technologies such as ADSL in an interconnected environment can create intermodulation problems and degrade service quality. Similarly, the possibility exists that T1 lines could appear in a bundle, causing cross-modulation and interference with circuits that are owned by other carriers. When multiple operators are involved, there may be no coherent line testing, line segregation or binder groups. So, what is "technically feasible" may be, for all practical purposes, impossible to accomplish without service degradation originating in the outside plant.

In addition, new technology heightens the risk of an outage simply because technicians are unfamiliar with it and more likely to make mistakes. And often, these new technologies are not automated from a network management or operations support system (OSS) perspective.

THE SOLUTION:

Better Communication

None of the three scenarios necessarily will come to pass. But they remain definite possibilities, unless of all of us in the telecommunications industry address them in a timely manner.

Nortel and other vendors continue to pursue solutions to these and other networking challenges. Some of these scenarios can be addressed through

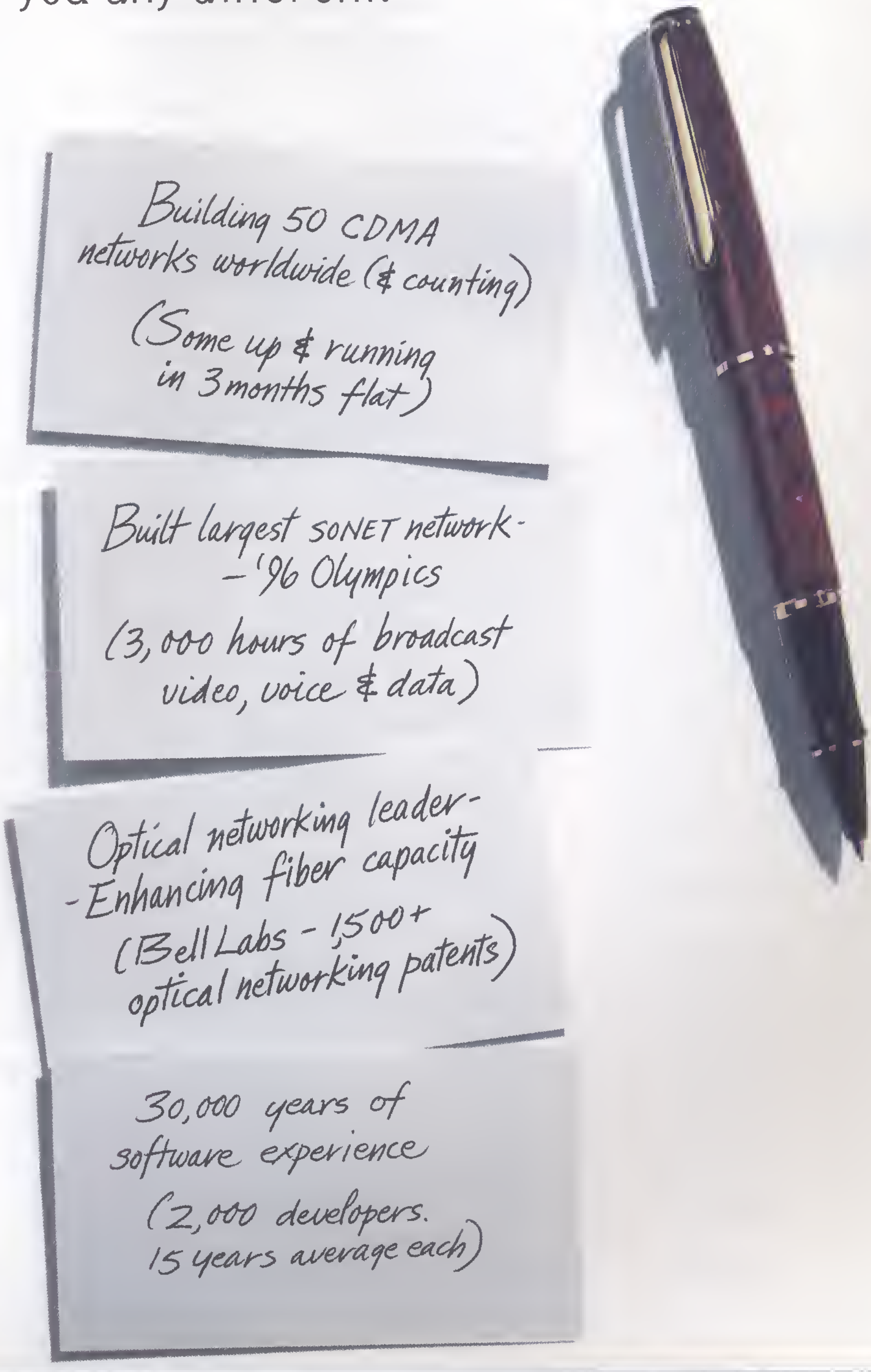
continued on page S-13

"Everyone tells me

they know their way around

networks.

What makes you any different?"



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technology solutions. But even those solutions require good-faith negotiation and agreement between the disparate parties involved.

One key component is participation in the Alliance for Telecommunications Industry Solutions, formerly the Exchange Carrier Standards Association. Among other activities, ATIS is active in developing testing procedures for local number portability. New entrants are urged to join this group, which brings together equipment vendors, incumbent local exchange carriers and other industry stakeholders. A committee established by ATIS, the Network Reliability Steering Committee (NRSC), monitors the health of the network and advises the FCC on reportable outages and other quality of service matters.

Nortel and other vendors also participate in the ongoing interoperability testing regimes at Bellcore where, among other activities, Nortel is a charter member of the ATM Interoperability Lab. Interoperability testing is used to determine whether individual products from multiple suppliers will interoperate and perform properly once they're placed in the dynamic conditions of a networking environment. Although its practices are no longer backed up by the force of regulation, Bellcore's range of experience in standards-setting activities makes it a unique resource for the industry as a whole.

Other outstanding organizations contributing to the resolution of interconnectivity questions include the National Reliability and Interoperability Council (NRIC) and the Network Interoperability Forum (NIOF). Government bodies, such as the National Telecommunications Industry Administration (NTIA) and the National Institute of Standards and Technology (NIST) also have roles to play.

One possible solution to maintaining high service-quality levels is outsourcing. Competitive LECs as well as ILECs have benefited from services of vendor organizations. For example, Nortel's Network Service Solutions (NSS) organization provides end-to-end network solutions, from consultation on network design to turnkey network monitoring and operation. Other vendors offer similar outsourcing alternatives which not only can be cost-effective, but which enhance network reliability as well.

At this point, no one can say whether interconnection will become the "nightmare" many seem to expect. But certainly a host of problems remain to be solved. Everyone in the industry—service providers and manufacturers alike—has a vested interest in contributing to open communication among all participants, so that these "nightmare" scenarios can be avoided. ■

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Interconnection... Interdependence

Will this impede or enhance public network reliability?

By Kim H. Lewis

President of SidCor Communications (Dallas) and director of the Network Management Forum (NMF)

> *When Alexander Graham Bell, after first spilling sulfuric acid on himself, transmitted the words, "Mr. Watson, come here; I need you," across a rudimentary phone line in 1876, he could not have possibly imagined that his invention would explode into the current technologically advanced, multibillion-dollar telecommunications industry. Nor could he have foreseen the amount of legislation, regulation and litigation that his invention would generate.*
>
> —JUDGE HANSEN, United States Court Of Appeals for the Eighth Circuit.

Telecommunications has become an industry of dramatically opposing forces struggling to find a balance. With the advent of the Telecommunications Act of 1996, deregulation/re-regulation and its associated mandates, new technologies, new services, mergers and acquisitions, and competition are converging simultaneously.

This convergence is a recipe for chaos in service and network management. Service providers old and new are evaluating and assessing technologies and information standards to support this brave new world of competition. Concepts including Quality of Service (QoS), time-to-market, return on investment (ROI), comparably efficient interconnection (CEI; access parity) and service differentiation all demand attention. Network and IT managers continually struggle to find methods to cope with:

- Decreasing operational budgets;
- Shrinking headcounts;
- Geometrically increasing needs for new applications and services, and management of those applications and services;
- Integrating and automating complex, monolithic operations support systems (OSSs) to serve new business purposes, such as automated interconnection;
- Interconnection of OSSs to other service and network providers and customers; and
- Assimilating new network technologies into an already-stressed environment, and upgrading employees' skill sets to capitalize on new information technologies.

The solutions to this complex and contradictory situation may mean the difference between success and failure. Clearly, new approaches are needed. Business-as-usual is a recipe for disaster.

The industry is assessing the use of emerging computing technologies to increase development productivity while reducing maintenance costs. Service providers are working together to define and support standard information models to support interconnection and management of services. Used together, commercial technologies and industry standards may achieve lower-cost development and faster time-to-market for interconnection solutions.

A little history...

The Telecommunications Reform Act of 1996 (the Act) identifies two key themes in Sec. 256:

- "...to promote non-discriminatory accessibility by the broadest number of users and vendors of communications products and services to public telecommunications networks used to provide telecommunications service."
- "...to ensure the ability of users and information providers to seamlessly and transparently transmit and receive information between and across telecommunication networks."

"And all this is to be done while ensuring the reliability of the network and accomplishing the primary goal of the Telecommunications Act," says Reed Hundt, former chairman of the Federal Communications Committee (FCC). Hundt made these remarks in reference to opening up the local loop to create equal access for competitive local exchange carriers (CLECs) while at a July 15, 1997, meeting to receive the final report of the Network Reliability and Interoperability Council (NRIC).

The Telecom Act stipulates specific actions to be taken by incumbent local exchange carriers (ILECs) before an ILEC can operate as a CLEC and have access to other ILEC properties. The incumbent carrier must create an environment to support equal competition, allowing the CLECs to have access to and the ability for wholesale purchase of services provided by the ILEC.

Equal access must be provided to network elements, according to the Act. All network elements related to transport, switching and access are included in this mandate. If advanced data services are provided by an ILEC, then all related bridges, routers and data switches must be made available to the CLEC. In addition, access must be provided to poles, ducts, conduits and rights-of-way owned or controlled by the ILEC, as well as the related OSS information for operation, administration, maintenance and provisioning (OAM&P) management of these facilities.

Bottom line: The local loop must be unbundled, with full access to transport switching, access resources and OAM&P functions that are part of the wholesaled service.

Access to databases and associated signaling necessary for call routing and completion also is required under the Act. Finally, non-discriminatory access must be provided to 911 and E-911 facilities, directory assistance, white pages directory listings, customer information (including telephone numbers, and names and addresses), number portability databases, and operator call-completion services. Local dialing parity (LDP) must be maintained between the ILEC and all CLECs.

One regional Bell operating company (RBOC) has stated: "An interesting aspect to consider is the privilege of a CLEC to co-locate their equipment within my central office (CO) in my specific region. However, I, in turn, would be able to capitalize on the situation and actually be able to wholesale-purchase the CLEC properties that are co-located in my CO."

Bottom line: Interconnection and interdependence is created by the Telecommunications Reform Act of 1996.

For complete success, the CLEC must have in place its own OSS that will monitor and manage services wholesale-purchased from the ILEC for resale. Further, the ILEC must enable the CLEC to interconnect to the ILEC's OSSs for specific management information of those same services. This portion of the unbundling effort is a tremendous challenge to the ILEC.

continued on page S-18

With the passage of the Telecommunications Act of 1996 and resulting competition and deregulation, the CLEC community has grown significantly. To date, public utility commissions have authorized more than 528 entities to provide local exchange service. In 1996, the CLEC community experienced its single greatest growth spurt, expanding in numbers by more than 500%. According to the Paradigm Resources Group and Connecticut Research Inc., "most of the 528 'certified' local exchange companies are providing pure or predominately 'resold' services, long distance services and ILEC dial tone, packaged and branded under the reseller's name." Many of these CLECs are, or plan to become, facilities-based carriers offering a range of switched services.

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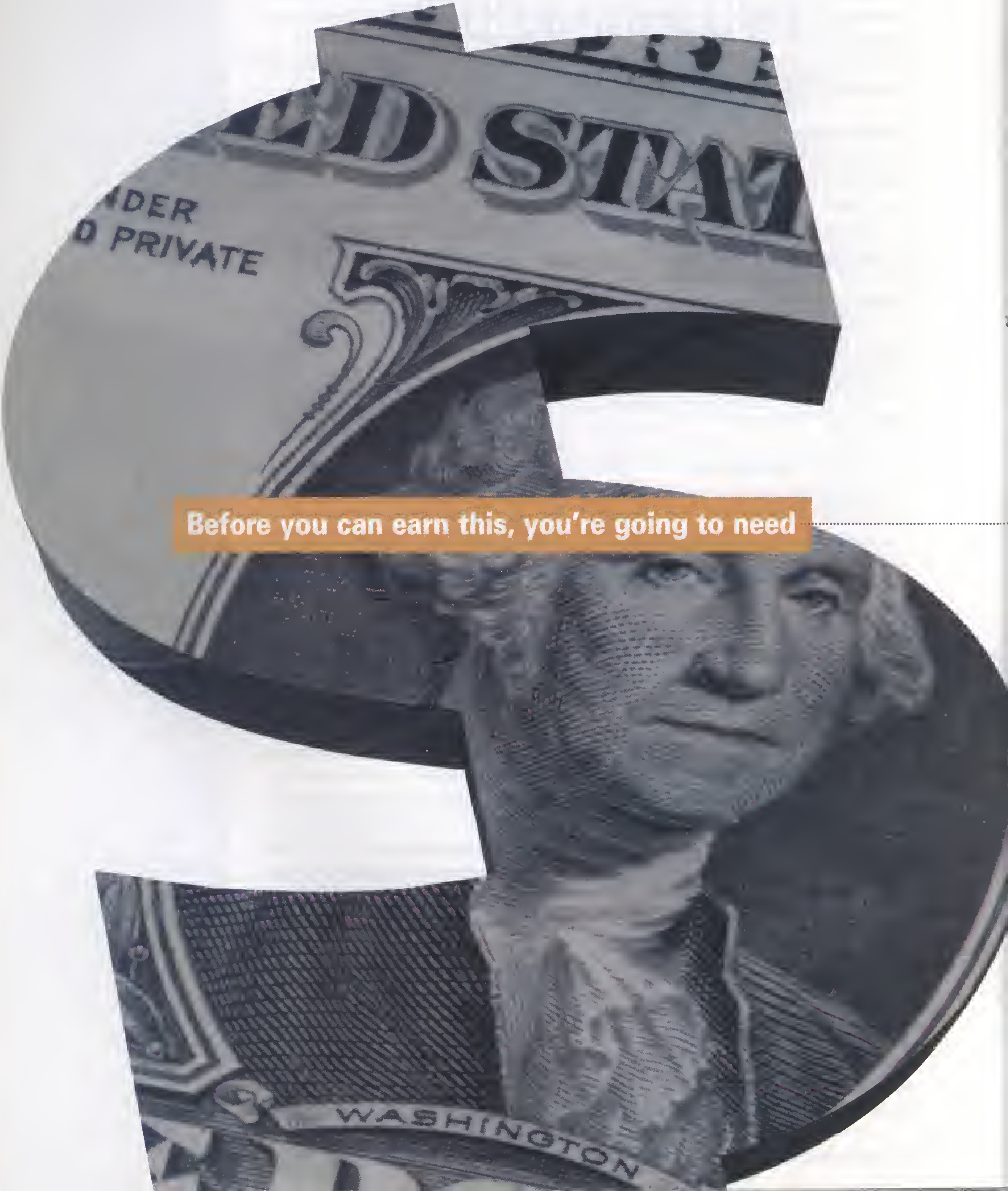
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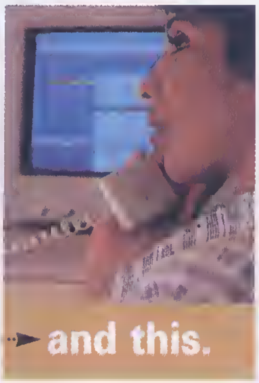

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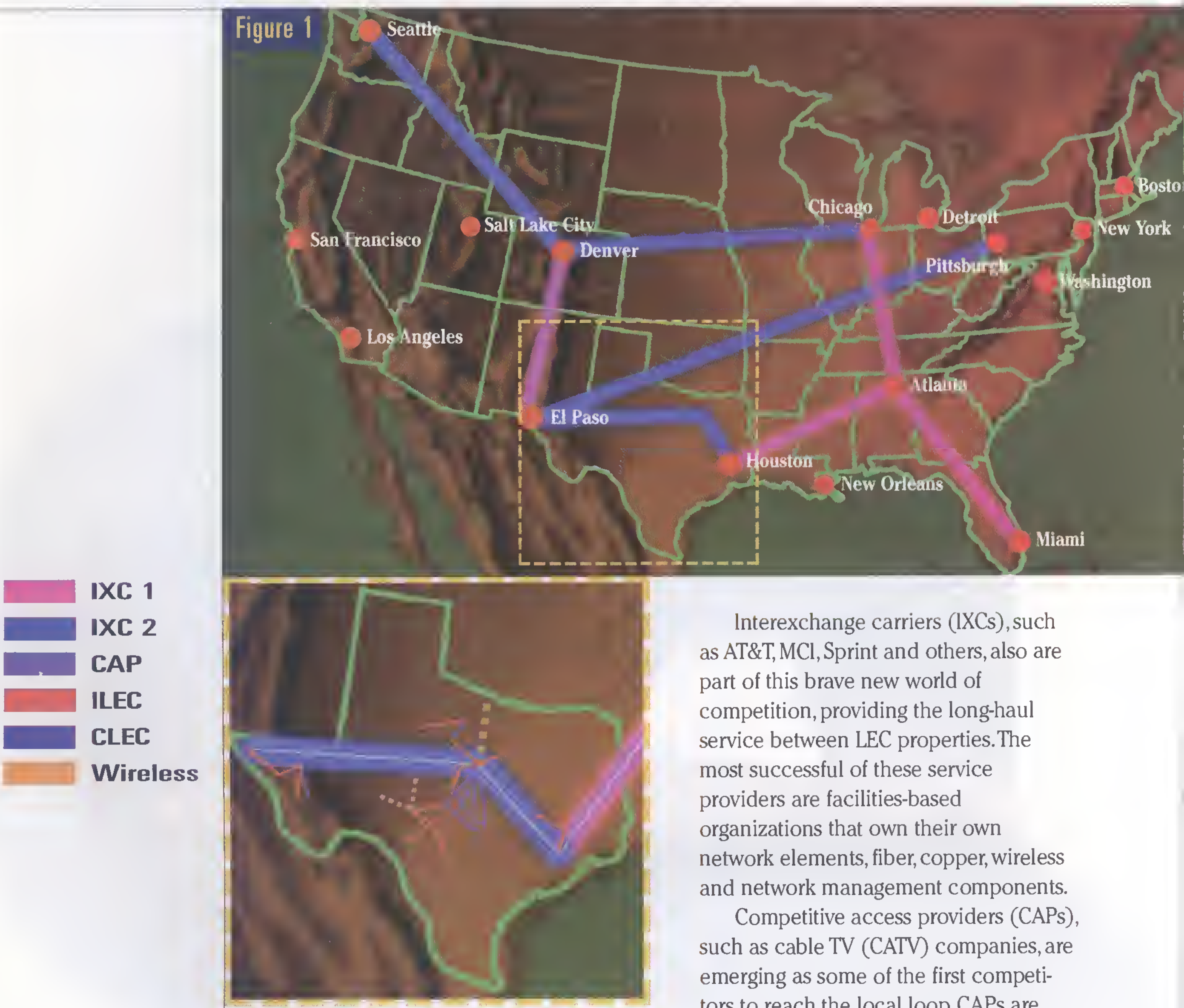
Figure 1



How is the industry shaping up? The telecommunications industry is taking on a "new look" as a result of competition and the inception of the Act. New players are emerging and participating in the interconnection of the public network as defined by regulation.

The incumbent carrier (such as an RBOC, GTE or other LEC), as the "legacy" participant, owns the bulk of the infrastructure—logical, databases/OSS and physical network elements; central offices; copper, fiber and poles; and other such resources. The ILEC is required to unbundle its resources to all CLECs that wish to wholesale-purchase these components.

Interexchange carriers (IXCs), such as AT&T, MCI, Sprint and others, also are part of this brave new world of competition, providing the long-haul service between LEC properties. The most successful of these service providers are facilities-based organizations that own their own network elements, fiber, copper, wireless and network management components.

Competitive access providers (CAPs), such as cable TV (CATV) companies, are emerging as some of the first competitors to reach the local loop. CAPs are usually facilities-based companies that select specific market segments to provide service. These market segments are usually comprised of high-dollar, high-volume customers. CAPs generally install and sustain their own facilities to support their selected markets.

With the advent of the 1996 Act came a new breed of telephony service provider: the CLEC. According to the Act, the ILEC must wholesale its services, including physical and logical resources, to the CLEC. The more pragmatic CLEC will be (or become) facilities-based, leveraging its own resources with those of the ILEC to provide traditional as well as new, innovative services in targeted markets.

There are also the wireless service providers—companies providing cellular, personal communications services (PCS) and wireless data. As with wireline, wireless services need the ILEC, CAP and IXC infrastructures for long-haul and switching services.

Significant challenges exist to interconnect these interdependent service providers and ensure a reliable public network. Strict adherence to standards coupled with state-of-the-art general computing technologies will help enable service providers to deliver new and innovative services with affordable, efficient and effective management systems that will ensure a robust, flexible network.

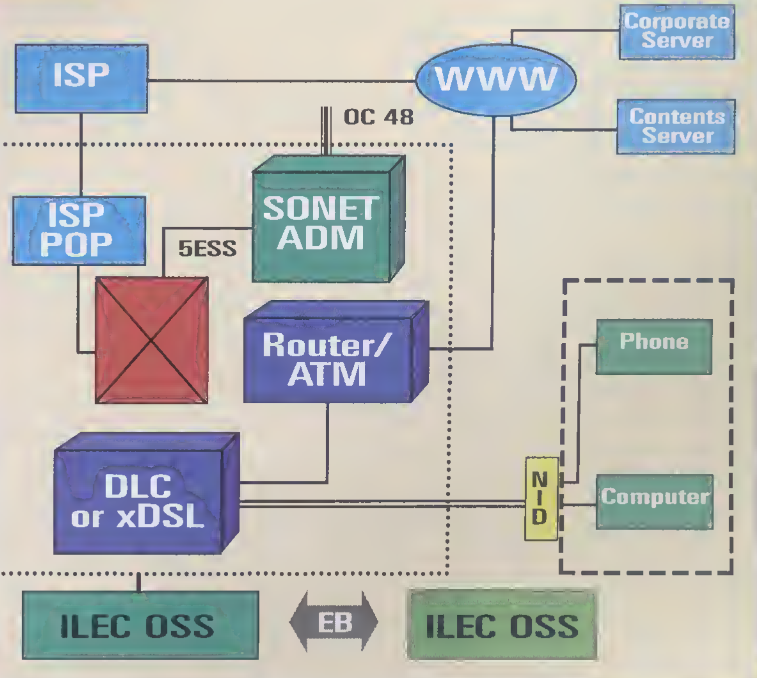
A glance at today

Plain old telephone service (POTS) is at the starting gate for interconnection. POTS is the simple ability to make and receive telephone calls. There are no enhanced services such as call waiting, caller ID and distinctive ringing attached to this service level. Interconnection of more complex services will follow the inception of interconnection for POTS.

For example, T1 is a digital transmission link that contains 24 64-kbps clear-channel voice channels. Relatively new to the telecommunications network are data and asynchronous transfer mode (ATM) services—sexy new services that generate premium tariffs. The key issues for interconnection into the voice network by these services is their distinct difference from traditional telephony services. ATM is a complex, cell-based technology that allows for the intermixing of voice, video and data cells. Cells can have priority as they move through the ATM network. In the case of video and voice, ATM will help ensure near-real-time delivery across the network.

With the introduction of complex voice, data and video services into the public network, interconnection takes on a new level of complexity. Traditional telephony services now combine with data services over the same wire. These services are facilitated by technologies such as high-bit-rate digital subscriber line (HDSL). Numerous service providers could collectively participate in the combined end-user service offering—including Internet service providers (ISPs), corporate servers, and the World Wide Web. Further, CLECs may wholesale-purchase the components of the ILEC infrastructure to offer these enhanced services to their respective customers. Transport and delivery mechanisms will include ATM, frame relay and xDSL. Network management systems will need to understand Transaction Language 1 (TL1), Common Management Information Protocol (CMIP), Simple Network Management Protocol (SMNP) and other protocols to provide reliable service successfully. Interconnection between providers' management systems will be required, whether by electronic bonding (EB) gateway-type solutions or other, non-standard and/or proprietary techniques. Figure 2 shows a complex network topology with numerous interconnections and interdependencies. The reliability of

Figure 2



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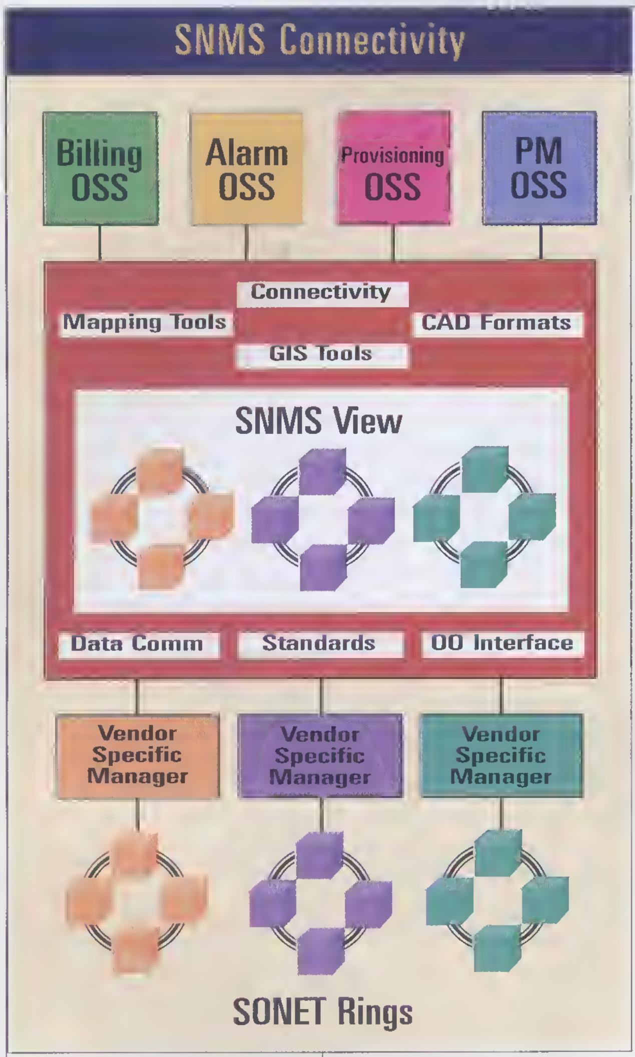
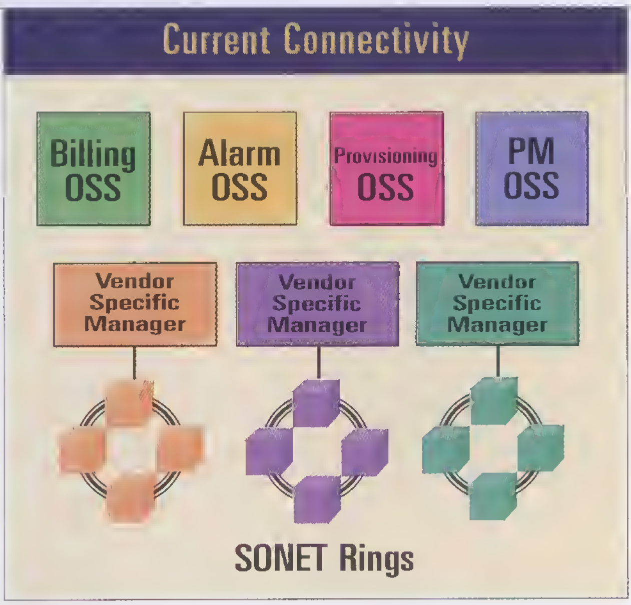




this network will be based on industry standards and OSS functionality. The services delivered to the customer premises consist of one POTS line and a data connection that bypasses the switch. In the case in which an ILEC is the ISP, connectivity to the Internet is direct. CLECs even can wholesale this capability; co-habitation in the central office is a reality. The equipment may be owned and controlled by an ILEC, owned and controlled by a CLEC, or a combination of both. Content providers, including corporate servers, also may participate in this interconnected, interdependent environment.

ILEC OSSs will need to interact with and connect to CLEC management systems. A CLEC must be able to view the network elements that support the CLEC wholesale-purchased unbundled network elements (UNEs) from the ILEC(s). Also, to support a bundled service offering to an end user, additional interconnections that could effect the reliability of the network and views of other participating CLECs and providers (IXCs, data-content providers and video providers) also must be made available.

An available, yet often misunderstood approach is to use special tools for spatial views of all network resources. New solutions, such as spatial network management systems (SNMS) will help ensure reliability of an interconnected network. "Integration of network data is key in enabling the validation of [service level agreements; SLAs] between ILECs and CLECs," says Craig Bachmann, executive vice president and chief operating officer for Information and Graphics Systems Inc. (IGS), a provider of such systems. "This integration should include a spatial component to address the myriad of regulatory, business and operational Geo issues."

For example, with an SNMS, network managers can obtain a regional view of the network. Network elements, major paths, wire centers, management centers, repair centers and network access points are made visible through an overlay of an actual map. "SNMS can solve both the internal and external

issues around OSS interconnection and interdependencies," Bachmann says. "The SNMS can bridge the gap between legacy-to-legacy connectivity, and support the addition of third-party suppliers and internal proprietary solutions to the network and service management mix."

SNMS solutions will benefit all service providers, providing views and connectivity between competitive (CLEC) and complementary (wireless, IXC) service providers that interconnect logical and physical network resources. The optimum SNMS solution will provide mediation of OSS to OSS, network data and spatial component to the management mix.

"The introduction of multiple service providers and multiple services (data, video and voice) in the local loop will put a serious strain on the reliability of our public network... unless the interconnection needs for network management are correctly addressed," says Steven Gordon, industry consultant and former vice president of product management at Fire Networks. "Service providers need to understand the burdens of interdependence that interconnectivity will place on their operations."

Service providers desperately need SNMS solutions. Issues such as reliability and extensibility need to be addressed in the solution set. The SNMS must be able to be installed in small test markets for CLEC endeavors and grow as the business becomes geographically successful. For ILECs, the SNMS must scale up to the size of large legacy OSSs and be able to scale down for small remote areas in their respective regions. For both camps, the SNMS must be able to incorporate new service and service bundles with minimal adjustment to the system.

Who's helping?

Physical network interconnectivity standards are critical to the reliability of the telecommunications network. For the interconnection of services to take place, network elements that provide transport, switching and access capabilities need to have standard definitions relative to issues of interoperability. There are several standards bodies and working groups whose purpose is directing service providers to agreement on standards and guidelines that support interoperability of diverse vendor equipment and technologies.

Some examples of these organizations and their domains of responsibility are:

· **The International Telecommunication Union (ITU)** for Broadband ISDN (B-ISDN), Signaling System 7 (SS7), IMT-2000, Intelligent Networks (INs), Synchronous Digital Hierarchy (SDH) and digital loop carrier (DLC) for international issues;

· **Committee T1** for B-ISDN, SS7, PCS, IN, Synchronous Optical Network (Sonet), and DLC;

· **The Telecommunications Industry Association** (TIA) for private branch exchanges (PBXs), cellular, PCS and others; and

· **Bellcore** for Sonet, SS7, DLC and switching issues.

The reliability of interconnection is ensured by the specific implementation of each standard. For example, in Bellcore's TR-NWT-000057, functional criteria for DLC systems are defined in great detail; transmission, signaling, loop voltages, interfaces and many other aspects are specified. Issues such as ISDN integration are specified in Bellcore's GR-303. These standards help to ensure reliability of the interdependent components for access to the DLC local loop and for how the access network is connected to the switching fabric of the network. Interconnection and interdependence are equally specified.

Physical network interconnectivity standards are not enough, however. With automation of service and network management functions, service providers have an equally important need for the standardizing process (for fulfillment, assurance and billing) and for standardizing the information that will flow through these processes. This is critical for

The Spatial Network Management Systems approach resolves the following Interconnect and interdependent issues:

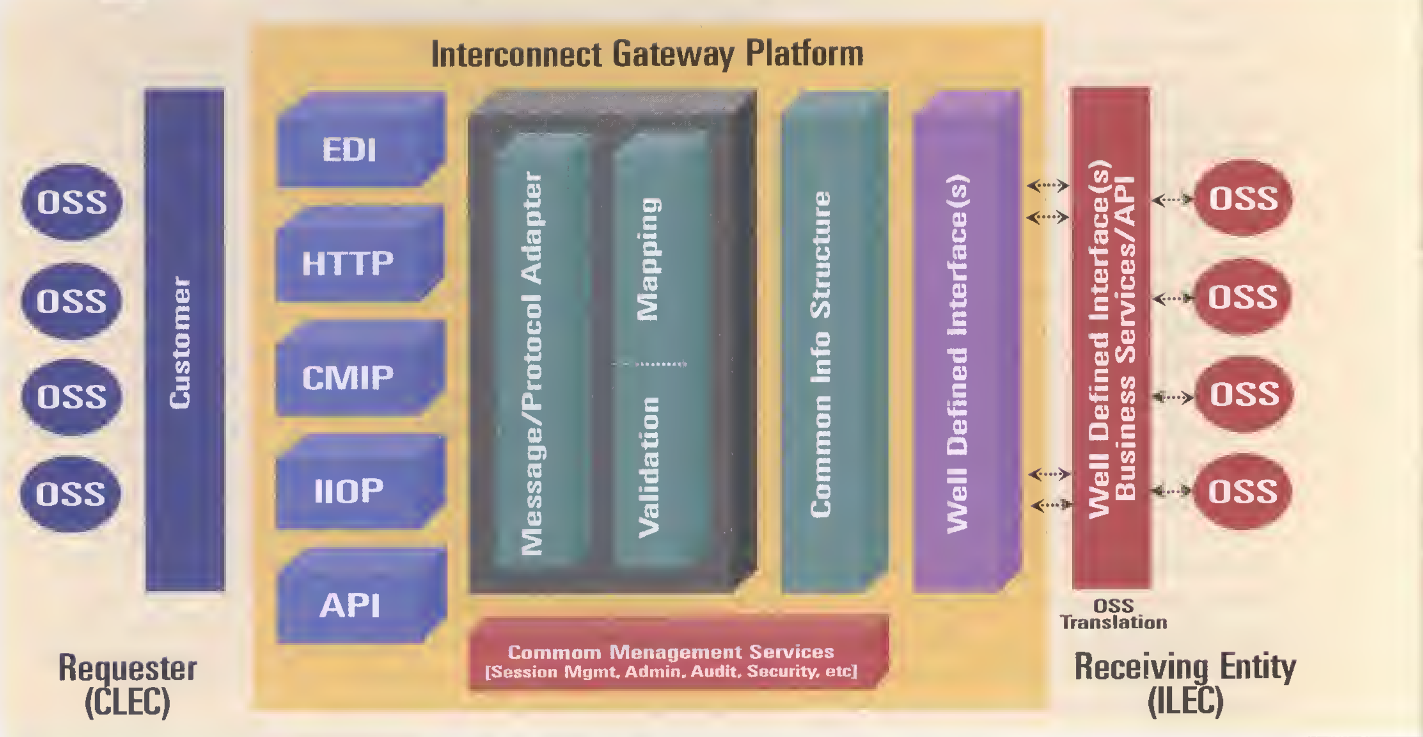
- **The need to make the service provider network more reliable and reactive.**
- **Provide customers with services faster than previous capabilities and competitors.**
- **Enable the delivery of new and innovative services and service bundles.**
- **Find and repair faults faster.**
- **Selectively provide wholesale information to CLECs, protecting successful business process and enabling CLEC-type activities by the ILEC through compliance with the Telecommunications Act of 1996.**

monitoring the reliability of the network. Some organizations helping to achieve standardization and develop implementation guidelines include:

- **The Electronic Communications Implementation Committee (ECIC)**—ECIC was launched in 1993 by Bell Atlantic and GTE and has since become the leading organization for negotiating electronic bonding agreements between service providers and their customers. The committee focuses on the application interfaces for OAM&P information exchange.
- **T1M1.5**—The T1 committee is a sanctioned American National Standards Institute (ANSI) development group that identifies and develops network architecture, interfaces and protocols to support OAM&P applications.
- **The Ordering and Billing Forum (OBF)**—The OBF is a customer and provider forum that identifies, discusses and resolves national business issues. The OBF also develops North American industry business guidelines for billing, ordering and provisioning, provisioning, and customer account information.
- **The Network Management Forum (NMF)**—NMF is a global consortium of more than 230 member companies. Its emphasis is almost totally on integrating the processes and systems of the service providers—delving into network and service management issues, including customer care. NMF's main goal is to provide a clear, unambiguous direction toward a target operational environment for service providers, promoting end-to-end flow-through of information across a multiple-provider, global service delivery chain. NMF enables service providers to supplement their own internal development with bought-in software. NMF also supports a technology framework to ensure that software components will "fit" within the end-to-end structure, and that they will interoperate technically. The NMF asserts an industry leadership role, influencing buyer/seller behavior, regulatory action and standards.

The moral of the story

As new technologies and service providers are introduced into the local loop and interexchange domains, mediation functions become more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Well Defined Interface(s) Business Services/API
OSS
OSS
OSS
OSS
OSS Translation
Commom Menagement Services
[Session Mgmt, Admin, Audit, Security, etc]
Requester (CLEC)
Receiving Entity (ILEC)

important. The data communication network and its OSS infrastructure cannot easily adapt to the new management protocols and transports used today.

For example, ATM switches are managed by SNMP as defined by the ATM Forum. New Sonet transmission equipment has CMIP as its management protocol interface. The typical Bellcore OSS utilizes TL1 as its preferred interface to the network. Additionally, vendor-supplied network managers are able to take advantage of advanced services supported in their own proprietary network elements. An example of this situation is remote software download; the application requires the Open Systems Interconnection (OSI) seven-layer stack with FTAM. The data communications network is X.25 or, in certain cases, frame relay. These non-OSI transports will not support the functionality of FTAM. What's a service provider to do?

To create interconnected networks that are reliable and efficient, a mediation function needs to be in the network between the legacy OSS, non-OSI wide area network (WAN) and the newer network elements and their respective vendor applications for element management. These (software) devices will run on general computing platforms running Unix or WindowsNT. They will provide conversions between the three-layer X.25 stacks to the seven-layer OSI environment. Furthermore, a mapping function from the object-based CMIP to the text-based TL1 will reside at the mediation device. In cases in which SNMP is required for ATM and data elements (routers, data switches and bridges), this translation tool can be incorporated into the mediation device.

By using the capabilities of mediation, service providers can install new technology, allowing CLECs to install their own technology and have an interconnected network that is reliable.

Nonetheless...!

Reliability within the interconnection guidelines of the Telecom Act is at risk. The evolution of SLAs as a contractual medium to specify performance criteria will address the reliability risk from a business standpoint. It will be implemented as a technical solution within the service, network and element management layers of the ILEC and CLEC services model, using the standards and guidelines being developed by industry working forums and standards bodies, such as those previously mentioned. Integration of the data will enable validation of the SLAs by correlating performance information with the "interconnected" facilities that are owned by the CLECs and ILECs.

When all parties have fulfilled the respective terms of their SLAs, a more comprehensive view of network reliability will be made possible. Efforts such as the Common Interconnection Gateway Platform (CIGP) project being developed within NMF will facilitate automated interconnection of certain OAM&P functions (in support of the FCC's non-discriminatory access mandates). Service providers are seeing the benefits to negotiating the common elements of an SLA in order to establish standardized service level agreements.

Standard SLAs will be the underlying factor in reducing the number of unique arrangements service providers must accommodate among themselves for identifying service and service-level descriptors, and for determining such things like performance requirements and service-level requirements.

All things considered, public network reliability can be enhanced by the integration of local, physical and spatial data within and across service provider domains. SLAs will support the interdependence of service providers by correlating performance information within "interconnected" facilities and their corresponding OSSs. ■

A proposal jointly submitted to the NMF in April 1997 by SBC and GTE, and approved by the NMF Board of Trustees, supports a new NMF Smart project specifically aimed at addressing the new OSS interconnection requirements being defined by service providers worldwide. The project team, jointly led by SBC and GTE, and comprised of service providers and vendors, will attempt to define a specific set of requirements for the development of NMF Component Sets and NMF Solution Sets to support a Common Interconnection Gateway Platform. The objective is to design an extensible architectural approach for the platform, and develop a production-capable pilot gateway system based on today's technology. The gateway will support, at minimum, five interconnection application areas, to include trouble ticketing, pre-ordering, ordering, provisioning and billing. For more information on this project, visit the NMF Web site at www.nmf.org.

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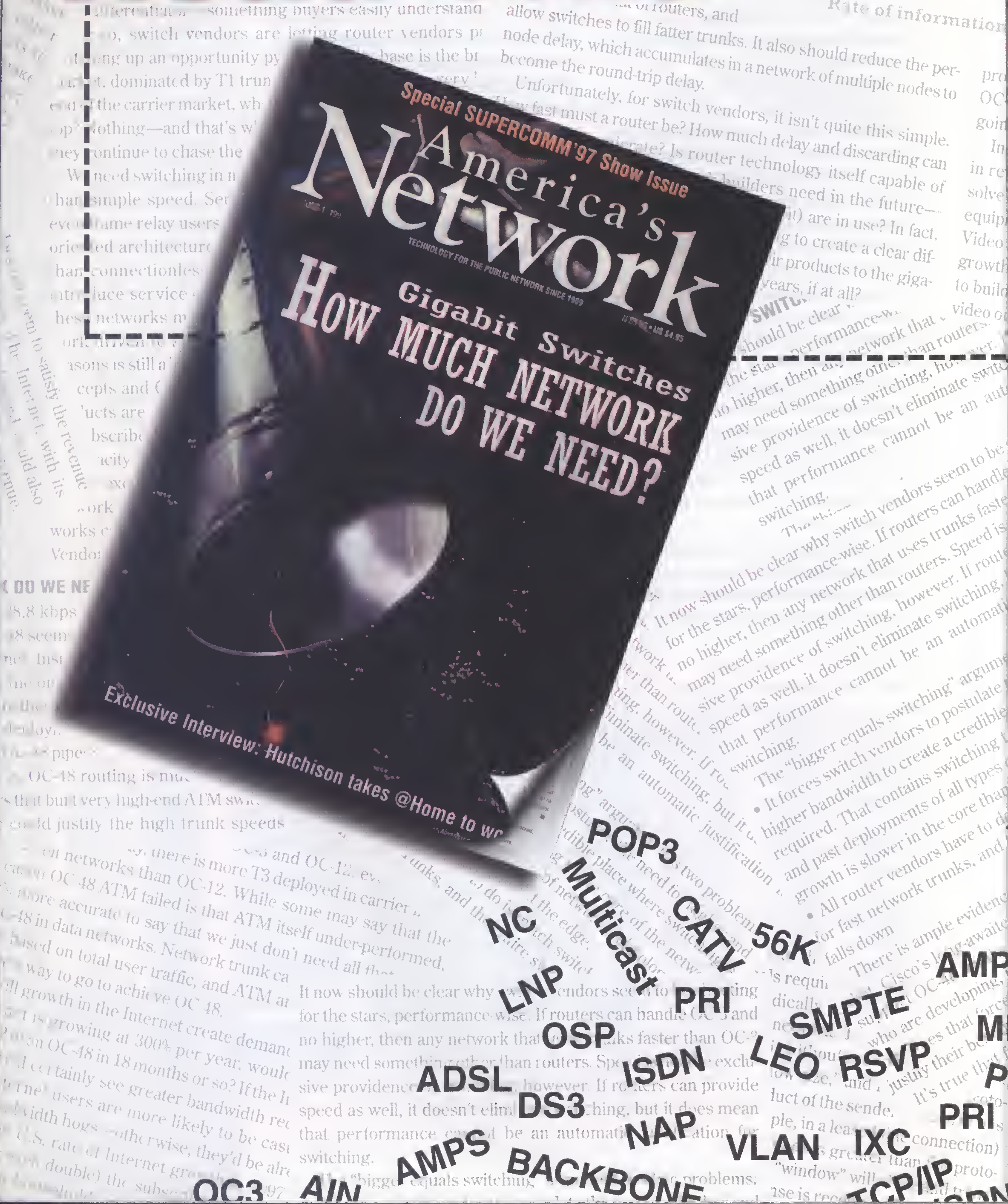
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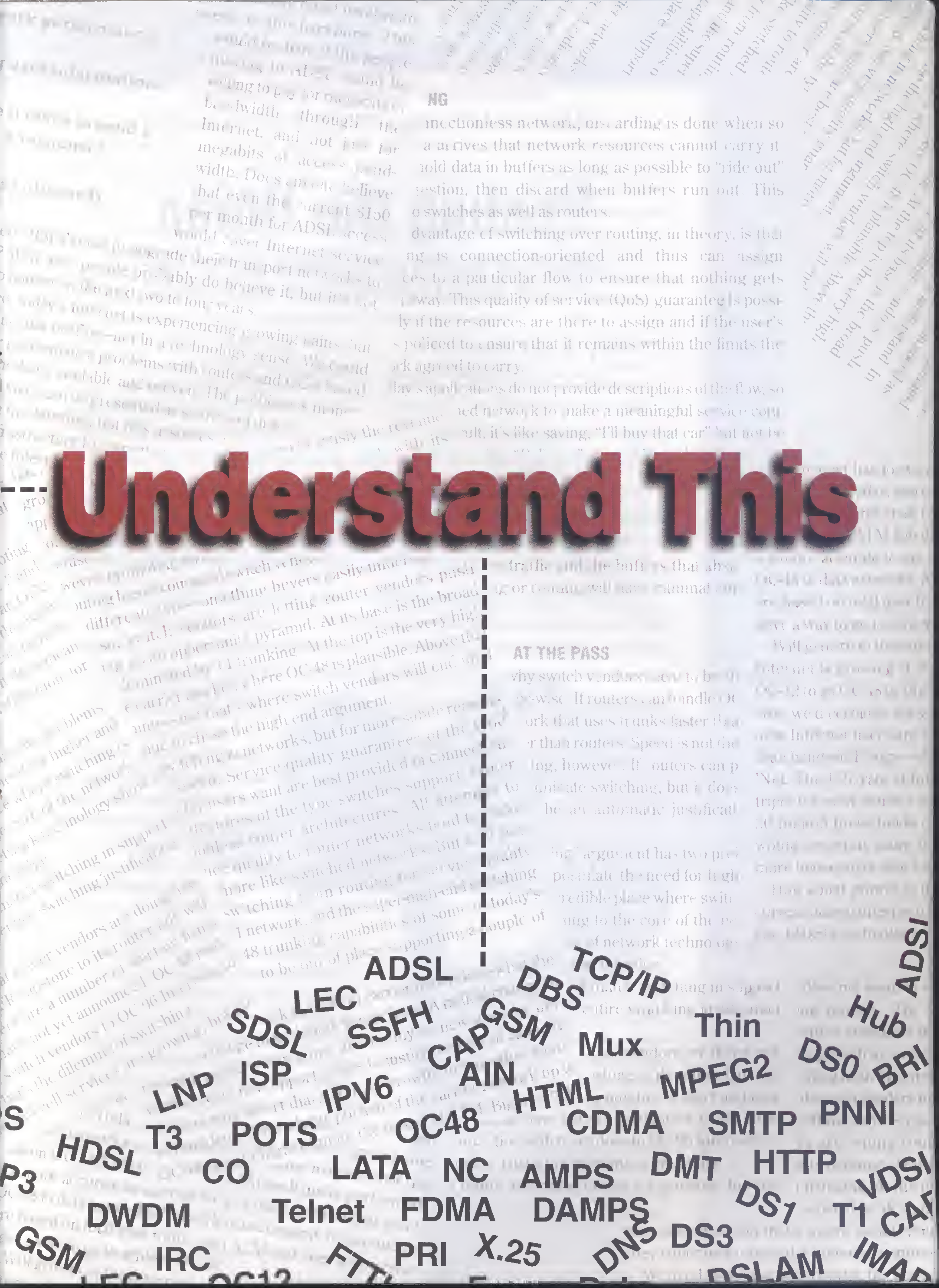


Peeling the Onion

Incumbents are preparing to attain reliability at every layer—but do the industry's newcomers realize what's in store?

By Curt Harler

Freelance telecommunications writer based in Strongsville, Ohio

Forget dime-a-minute or five-cent Sundays. As telecommu-nications services become more of a commodity item, the battle for customers is going to be waged over quality of service (QoS) and network reliability issues. Prices can only go so low.

While this change of focus—to reliability—will be most pronounced in the business market, it also will impact home users.

If there is one trump card carriers can play, it is their track record of network reliability. Come fire or flood, power outages or labor woes, the network continues to perform. Only a few failures (such as the Hinsdale, Ill., central office fire or the Signaling System 7 network outages years ago) have been so spectacular as to bring government investigation.

"Standards-based network management will take on increased importance, due to the changing structure of networks," says Kiran Khanna, communications industry analyst with Frost & Sullivan (Mountain View, Calif.). She says that architecture based on the Telecommunications Management Network (TMN) standard will let carriers view each element in their increasingly complex networks without investing a substantial amount of additional money in infrastructure. Under TMN, all operation and maintenance centers are linked in a centralized network which makes control, monitoring and management of all devices easier.

Because of its enhanced ability to provide proactive network management, the TMN architecture is being adopted "quickly" by local exchange carriers, Khanna says. The reason is simple: TMN allows all competitors in a market to manage the overall network effectively. Take, for example, a long distance carrier such as MCI, which wants to provide local service in Northern California. Most likely, MCI will lease wholesale lines from Pacific Bell. TMN will allow MCI to operate and manage each element of the expanded network.

A report from Insight Research (Parsippany, N.J.) underscores the point. Competing telecom offers are so abundant, the report states, and so similar in price and scope, that customer care has become a key market differentiator. According to "Carrier Customer Services and Operations Support Systems," it's time that carriers "reach out and touch" their customers at least once a month to emphasize the differences in quality and service available from the carrier.

Wayne Davis, director of network planning and administration at Century

Telephone Enterprises Inc. (Monroe, La.), says his company puts a strong internal emphasis on Synchronous Optical Network (Sonet) rings. Sonet is emphasized on the access side in larger, urban networks.

"We present the Sonet reliability as a value-added item, particularly to our commercial customers," Davis says. While some of Century's commercial customers are demanding QoS provisions in their contracts, Davis feels that, as long as the service is good, it will not become the focus of attention. "But we make it a point of letting them know we provide this redundancy," he acknowledges.

Need for survival speed

While self-healing Sonet rings are almost commonplace in the business today, the need for speedy restoration will become more acute as carriers deploy networks based on wave-division multiplexing (WDM). Network management procedures likely will not be prime candidates for network restoration, for any process that takes seconds or even minutes to execute is out of the question. Rather, look for restoration management to be done at the network level, where restoration times in the 50 millisecond range prevail.

The single largest reason for network failures remains cable cuts, accounting for about 25% of all outages. Ray Albers, vice president of network architecture for Bell Atlantic (Arlington, Va.), chairs the Network Reliability Steering Committee, which reports on outages to the Federal Communciations Committee (FCC). "Quarter after quarter, the biggest source of outages is facilities failures—mainly, cable cuts," he says. The Alliance for Telecommunications Industry Solutions (ATIS; Washington) continually reviews statistics (without pointing fingers) with the goal of improving network reliability.

Bell Atlantic does the same thing internally, using a voice-mail broadcast to all management any time a serious outage occurs. Albers notes that configuring self-healing rings with protection circuits has gone a long way to reducing the number of failures. As a result, most failures are the result of circuits being moved from place to place, resulting in cables sharing the same duct or pole.

"Ultimately, restoration of a WDM-based optical network will have to be quicker than Sonet," says Jim Sauer, manager of Fujitsu Network Communications' broadband transport group. The very nature of the network—with an optical network on top of an Internet protocol (IP) or asynchronous transfer mode (ATM) network—demands that optical must be the quickest to restore. To break that rule is to invite further disaster. "If the Sonet is quicker than the optical path, then you will have multiple iterations of switching as the network heals itself," he notes. "Restoration has to be designed so you do

> **Telcos are waking up to the fact that network management can be a good source of indirect revenue.**
>
> —Kiran Khanna, Frost & Sullivan

> **Restoration has to be designed so you do the recovery at the lowest level. You have to design optical restoration that is quicker than the level above it.**
>
> —Jim Sauer, Fujitsu

the recovery at the lowest level. You have to design optical restoration that is quicker than the level above it."

Customer pressures

Already, companies such as Ameritech (Chicago) are getting pressure from their customers to take steps to assure a robust network. Bill Heilenbach, director of network engineering and planning for the regional Bell operating company's (RBOC's) Advanced Data Services unit, notes that more pressure is coming from data customers than from voice users, but these customers are begging to be reassured about the survivability and QoS being provided.

Survivability challenges will be more acute, Heilenbach says, as newer, less experienced players get into the game and as customers break up their networks, giving parts of the traffic to different carriers. "That makes it more difficult to troubleshoot problems," he says. "The customers on the data side are more aware of the need for survivability and reliability. Financial networks have to meet stringent government requirements. They expect the same kind of reliability from their service provider."

While Heilenbach is proud of the 99.992% switch availability figure Ameritech has achieved, the RBOC is focusing on two areas to further assure reliability. Today, the carrier offers its customers dial backup to assure redundancy of their DS0 or DS1 networks. Moreover, it is investigating its ability to design a hot site for backing up their own neetwork.

"In a major catastrophe, this would let us re-route traffic," Heilenbach says. The site would function like an in-house Comdisco service, and would serve the entire network.

What it's really worth

What is that kind of disaster-recovery and survivability worth to a company in the midst of a major product rollout? Network management today is rarely seen as a profit center. In most cases, network management equipment and personnel are entered as expense or overhead. More progressive firms are starting to view network management in terms of an indirect profit item.

"The telcos are waking up to the fact that network management can be a good source of indirect revenue for them," Khanna says. "Customers will not be making their decisions on price, but on the level of service and the quality of service they get."

Nothing brings giggles faster to a table of telco executives than a discussion of the reliability of CATV services or alternative-provider networks. But the humor is tempered by the knowledge that every-one is trying to improve service—and that the worm could turn at any time.

Telcos experience about 40 serious outages nationwide each quarter. The FCC requires telcos to report outages that affect 30,000 customers for 30 minutes or more. "While the number of outages has not decreased, the network has grown by 19% in call volume and 23% in number of minutes," Albers says.

Figuring against the 1992–1993 base year, Albers believes that the ability to hold outages steady in the face of increased usage is a victory, of sorts. Still, ATIS is looking at a number of recommendations, including promotion of one-call legislation, which should go a long way to eliminating the cable-cut bugaboo. Other steps are being taken as well.

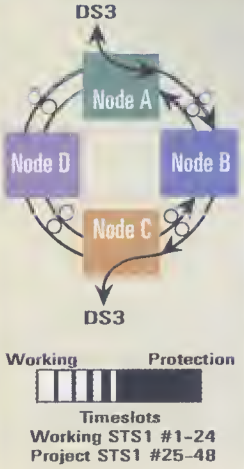
Ameritech performs several mock disaster drills annually. The focus is on four areas:

- The switch and central office site;
- Facilities;
- The network manaagement system; and
- Administration, including billing.

There have been live runs in the first three years. Billing is next. "It is important to have a robust billing system," Heilenbach notes. "If you don't, if affects customer service."

Robert Rosenberg, president of Insight Research, predicts telco investment in

BLSR Overview



- Time Slots 1-24 used for working Traffic
- Time Slots 25-48 used for protection
- Traffic flows in both directions (east & west)
- No separate protection fiber or signal

Degrees of Systems Availability
(per annum)

% Available	*Downtime*	*Class/Type*
99	3.5 days	Conventional
99.9	8.5 hours	Highly Available
99.99	1 hour	Fault Resilient
99.999	5 minutes	Fault Tolerant

*Scalable Performances & Availability="Clusters" Conclusion

customer care and billing will grow 13.6% from 1997 to 2002, topping $19 billion by the end of the forecast period. That's nearly twice the expected rate of increase in carrier revenues. "That faster growth rate stems from an increased focus on small-to-medium businesses and high-value residential customers—folks who spend $300 to $500 per month but aren't secured with an annual contract. They're free to roam, and that's a scary prospect for the telcos."

Redundancy

The modern network is built with N+1 redundancy, providing the extra route should a line cut or other disaster occur. Central office equipment is built with fully redundant and hot-swappable parts.

Current WDM networks with 1+1 redundancy are experiencing recovery times in an order of seconds. That rate will improve quickly through 1998. With dense WDM (DWDM), carriers will demand bidirectional line switched ring (BLSR) in the optical domain. BLSR is a method of Sonet transport in which half of the working traffic is sent counter-clockwise over another fiber. BLSR offers bandwidth-use advantages for distributed traffic in single-ring architectures. BLSR can be contrasted with unidirectional path switched ring (UPSR), which is a Sonet transport method in which the working traffic goes only in one direction. It is the preferred method for inerconnecting rings with numerous signals crossing rings. BLSR functionality is required on match node, drop-and-continue for dual-node interconnected rings, for protection against the loss of a central office, and on four-fiber BLSR for the long-haul network.

Davis says Century Tel emphasizes next-generation digital loop carriers (DLCs) on its access networks. "They give us the ability to provide multiple bandwidth services and Sonet ring protection," he notes.

Century Tel is planning to build at least one and perhaps two more Technical Assistance Centers to complement its current Hardy, Ark., site. Number and location of other centers will depend on operational geographics. The sites also will be used for daily translation, test and backup services. In addition, Century Tel is going through a program of collapsing host switches. With fewer host switches and more remote sites, there is less chance of failure, according to Davis.

Down the road

While Davis feels Century Tel has a grip around many of today's challenges, he predicts these challenges will be revisted in a few years as wireline and wireless networks blend. "Then, we'll be back, again, to the basics of switching platform reliability," he says.

"If I have one worry, it is that the new entrants pay their dues in terms of putting people on the committees that deal with survivability," Albers says. He fears that smaller players will be content to sit on the sidelines, content to leave the three major IXCs to work on common standards. Albers notes that implementing procedures to correct SS7 problems cost each telco a couple of million dollars in software, and hopes that newcomers in the industry are prepared to spend that kind of money.

As ATIS peels the next layer of the onion, local switch outages are likely to be the target. Procedural errors are second to facilities failures as prime causes of outages.

Beyond that, the onion has other layers. They say that pride goes before a fall. Executives proud of their network survivability would be well-advised to stay on top of the latest technology and techniques, lest they be blindsided by the current glow of their success. ■

> **If I have one worry, it is that the new entrants pay their dues in terms of putting people on the committees that deal with survivability.**
>
> —Ray Albers, Bell Atlantic

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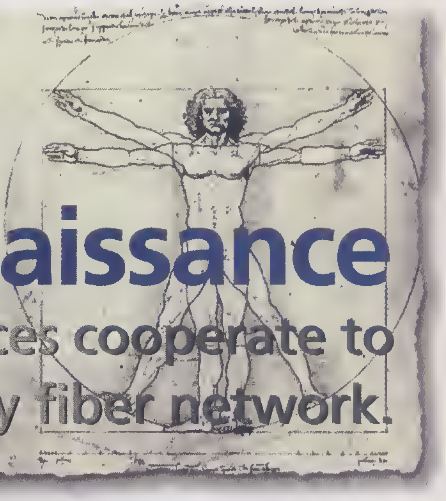


MATT COX AND STEVE POMP

Powering Project Renaissance

Bell Atlantic and Energis Resources cooperate to fuel this innovative New Jersey fiber network.

IN 1995, BELL ATLANTIC LAUNCHED PROJECT RENAISSANCE in Passaic, N.J., in an effort to deliver a high-end, fiber-to-the-curb (FTTC) network, at a competitive cost, to a community with a wide range of real-world application challenges. There were a variety of key issues associated with powering this network. They included:

- Using limited rights of way for the network's power infrastructure;
- Using the existing infrastructure in the most cost-effective manner; and
- Solving engineering problems associated with interfacing existing power sources with new power sources.

Historically, the carrier that owns the network also owns and takes responsibility for the system that powers that network. In keeping with the Project Renaissance name, Bell Atlantic decided to investigate an alternative method of powering the network's optical network units (ONUs). It investigated the possibility of farming out the task to Energis Resources, an Edison, N.J.-based energy services company. The company is an affiliate of Public Service Electric and Gas Co. (PSE&G) one of the largest combined electric and gas utilities in the nation. Passaic is within PSE&G's electric service territory.

Energis Resources offered Bell Atlantic a local powering methodology using a pole-mounted power hub with battery backup. The power hub is equipped with monitoring and fault-detection software that can track a range of powering parameters and alert centrally stationed system operators of abnormalities when they occur. Energis Resources owns, installs, operates and maintains powering equipment for the Project Renaissance network.

PASSAIC'S CHALLENGE

Located in a heavily commercialized and congested corridor, Passaic, N.J., is densely populated and demographically diverse—characteristics that stem from the city's proximity to New York and the fact that it is one of the oldest communities in New Jersey. The town has been forced to respond to rapid change and growth with little time for long-term planning and limited room for lateral expansion. The physical infrastructure of the town is dense, complex and frequently haphazard.

Bell Atlantic selected the town for this project, because it presented the regional Bell operating company (RBOC) with a range of highly interesting fiber optic telecommunications challenges in a limited and well-defined area—more simply, it gave Bell Atlantic a chance to apply and test several technologies as potential solutions to a number of target problems. The town's economy mandated that Bell Atlantic provision an FTTC network at a competitive cost.

Passaic's aging, primarily copper outside plant also was ripe for an upgrade. The old network provided an average of 1.2 access lines per living unit.

NETWORK SPECIFICS

In building an advanced optical network for the city, Project Renaissance engineers and planners parsed the area into seven categories of significantly different neighborhoods.

Each area was delineated by the unique requirements it placed on the design and configuration of the fiber optic network if the network was going to service customers reliably and cost-effectively.

Wherever possible, the new network uses existing remote terminals (RTs). Bell Atlantic has added only a few RTs to the network because of density considerations. When completed, the telephony-first, video-upgradeable network will employ more than 100 LiteSpan 2000 next-generation digital loop carriers (NG-DLCs) from DSC Communications (Plano, Texas). The DLCs will be served by a Nortel DMS-100 central office (CO) switch.

Most of the DLCs are being deployed in a star architecture. Host digital terminals (HDTs) in the CO feed telephony—and, eventually, video—directly to pole-mounted ONU 24s (an ONU 24 serves 24 voice grade lines), ONU 48s and ONU 96s that are strategically located in the neighborhoods they serve. Where possible, the DLCs have been placed in existing RTs.

Telephony service is integrated into the DMS-100 via TR303 interfaces on the DLCs.

The lines with the TR303 interfaces are engineered to operate at a 7:1concentration ratio. The in-service video upgrade will enable the network to deliver switched digital video (SDV) at 51 Mbps to each living unit via twisted pair.

THE POWER SOLUTION

The physical density and complexity of the Project Renaissance serving area made it difficult—and, in many cases, impossible—to obtain rights-of-way for network elements such as controlled environment vaults (CEVs), huts and power node cabinets. Energis Resources offered Bell Atlantic a powering solution that did not require new rights-of-way, thus allowing the RBOC to build out its network and turn up new customers more rapidly.

The power supplies are local units that can power from one to four ONUs within a 600-foot radius. They consist of the Energis Resources CB800 power hub, a network interface device (NID) and the requisite connections from the utility-provided alternating current (AC) power source (see figure 1).

The power hub was designed exclusively for fiber optic networks. Weighing in at roughly 240 lbs. with battery pack, the hub requires 120 volts AC (VAC) input power and delivers –130 V direct current (VDC) output power. Its National Electrical Manufacturers Association (NEMA)-4 galvanized steel enclosure is about 24 inches tall, 18.5 inches wide and 13.5 inches deep.

The power hub receives 120 VAC power directly from the local utility secondary wire (located directly above the hub near the top of the utility pole), converts it to –130 VDC, and distributes the power across eight output channels. The hub's power input and output points incorporate integral overvoltage protection, and each output channel is power-limited at 100 volt amps (VAs).

The eight output channels connect, using eight pairs of 19-gauge solid copper conductors, to the NID positioned alongside the power hub. The NID acts as a point of demarcation between Bell Atlantic and Energis Resources equipment. Energis Resources owns all of the hardware from the AC source up to and including the NID. Bell Atlantic owns the wires used to distribute the power from the NID to the ONUs.

> **The NID acts as a point of demarcation between Bell Atlantic and Energis Resources equipment, which owns all of the hardware from the AC source up to and including the NID.**

Lead acid, gel-cell batteries provide backup power for the ONUs. Energis Resources sized the batteries to meet Bellcore TA-909 specifications for eight hours of backup power for telephony service, and two hours of backup power for video service. Power for telephony and video are provided on separate channels.

A two-hour timer on the video side is activated in the event of AC power loss. At the two-hour mark, the power hub software signals voltage regulators to shut down the video power output channels. The ability to discontinue video power is beneficial, as video customers likely will not have an AC source to power their televisions during a power outage, anyway. The additional battery capacity saved by shutting down video service then can be used to serve telephony customers.

The power hub also is equipped with an auxiliary battery port. If more than eight hours of battery power are needed during an AC power outage, a spare battery can be used to power the hub while the depleted battery pack is replaced.

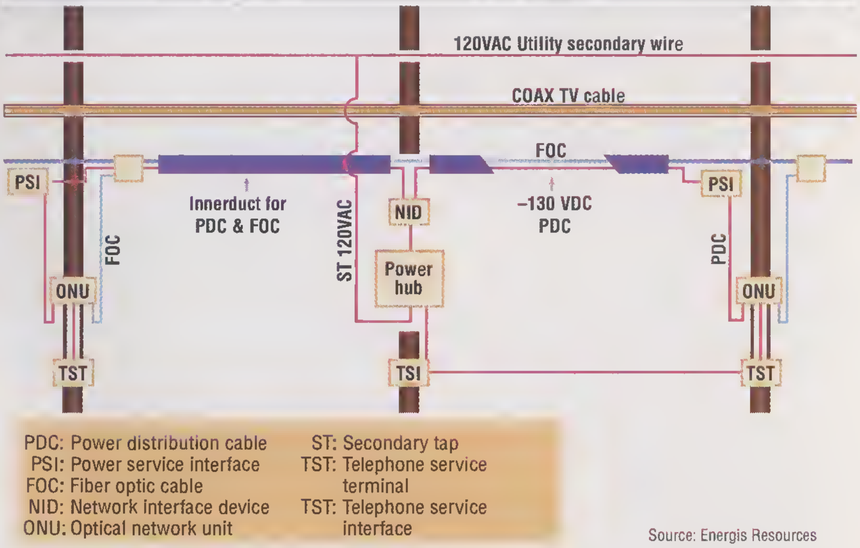
Should one or more output channels fail, the power hub's design allows it to be replaced without interrupting service to the output channels that are still in operation. A reserve power source is paralleled with the old power hub while the new hub is installed.

MONITORING AND COMMUNICATION

The power hub's monitoring system is seamlessly incorporated into the operating procedures and work environment of the power company's operations center. The system's hardware and software help optimize the response of systems operators and troubleshooters.

The software continuously monitors key operating parameters such as AC, rectifier, battery, output potential, output current and ambient temperature. A central monitoring computer at the power system operations office converts information sent by the power hub into user-friendly operating data. If the power hub exceeds a specified operating range, an alarm is sent via a modem in the power hub across a common subscriber line provided by the ONU. The phone call is received by one of seven modems dedicated to handling incoming alarm calls. An eighth modem is dedicated to outgoing communication between the system operator and the power hubs. Whenever an alarm is received, the system operator calls the power hub to confirm that an alarm condition exists.

Figure 1: Power hub service network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Power hub
ONU
ONU
TST
TSI
TST
PDC: Power distribution cable
PSI: Power service interface
FOC: Fiber optic cable
NID: Network interface device
ONU: Optical network unit
ST: Secondary tap
TST: Telephone service terminal
TST: Telephone service interface

Source: Energis Resources

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Circle 112

The monitoring system also triggers alarms concerning the status of the batteries at the power hubs. When an AC power outage alarm is received, the monitoring software automatically sets a six-hour timer. If the power is not restored within these six hours, the monitoring software triggers a second alarm to indicate that two hours of battery life remain in the backup pack. This way, the system operator is notified of the need to correct the AC power outage immediately or replace the power hub battery.

The monitoring system hardware consists of a central computer with mirror drives, tape backup and enough hardware to manage eight modems. Redundancy ensures the longevity of the databases, which store power hub location and operating data.

MAKING IT WORK

Bell Atlantic and Energis Resources have established three joint working committees to develop and oversee the implementation of the powering component of Project Renaissance.

The testing committee manages testing of the power hubs. The hub has been tested as standalone system and as an integral component of the ONU package. In addition to establishing that the hub met Bell Atlantic's technical and performance specifications and ensuring that it satisfied the powering parameters for the network's ONUs, the testing procedures allowed the committee to assess the hub's operating limitations.

The engineering and construction (E&C) committee conducted a comprehensive analysis to determine the optimum configuration of the power network based on project requirements such as reliability and cost-effectiveness. Power hub locations were matched with ONU locations throughout Passaic. A Bell Atlantic engineer

Figure 2: Pros and cons of outsourcing network powering

Pros:

- Allows communications and energy service companies to focus on their respective core businesses.
- Energy service companies have the experience to create powering solutions.

Cons:

- Adding a new layer to the powering solution adds dimension of complexity to a fiber optic network.
- Reinforcing work force knowledge on batteries and electronics.

Short-term challenges can be overcome as power outsourcing matures

Source: Energis Resources

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The outage response and restoration protocols had to include the roles both companies would take.

first selected a proposed power hub and ONU location; then, a Bell Atlantic surveyor—trained and proficient in power hub and ONU utility pole requirements—visited the location for final approval. Bell Atlantic sent engineering drawings to Energis Resources for a final field inspection.

Energis Resources managed the E&C committee's construction effort. Once each location received final approval, the power hub was installed and energized, and Bell Atlantic connected it to the network at the NID. The carrier connected an alarm and monitoring line to the power hub; then, Energis Resources contacted each power hub through the central monitoring system to verify that it was configured and operating properly. The power hub identification number and location were entered into the monitoring system database.

The restoration committee developed the procedures for responding to and restoring ONU power outages as promptly and effectively as possible. The development of these procedures was complicated by the fact that two companies owned systems and equipment with the potential to cause an outage. The outage response and restoration protocols had to include the roles both companies would take. This called for collaborative planning between Bell Atlantic and Energis Resources to develop joint response and restoration protocols to help restore service as quickly as possible, regardless of an outage's cause.

To date, Energis Resources has installed 472 of an eventual 2,000 power hubs in the Project Renaissance network, which now serves 4,000 customers. ■

Steve Pomp is manager of new technology deployment for Bell Atlantic (Freehold, N.J.). Matt Cox is a project manager for Energis Resources (Edison, N.J.).

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Circle # 111

OUTSIDE PLANT Notebook

Annie Lindstrom

Dashing through the snow

You've heard the saying, getting there is half the fun. Well, telephone companies and wireless providers that need to send maintenance and repair crews to remote sites during the winter months would probably disagree.

This year when the snow flies, however, carriers nationwide can hire professionally trained drivers and a high performance tracked snow vehicles (TSVs) to take them to and from their destinations by calling **Snow Transport Specialists L.L.C.** (STS; Littleton, Colo.). STS provides on-call transportation services for an annual retainer or an hourly fee, according to Glen Fishman, vice president of marketing for STS.

Courtesy Snow Transport Specialists

The company plans to have a snow vehicle and operator stationed within 100 miles of each location where it has a contract, says Art Seely, president and CEO of STS. That means a carrier that places an emergency call to STS can put a repair crew in motion quickly he adds.

"We pick you up within two hours and transport your repair crew to the remote site and back. We even bring the hot chocolate," Fishman says.

Carriers that use STS' services do not have to spend money on TSVs and driver training, which takes at least 16 hours. STS' drivers typically log 200 to 400 hours of driving time each year and they can keep repair crews out of trouble. The annual operating cost of owning its own TSV, training drivers and purchasing employee liability insurance costs a carrier more than $25,600 per year, Fishman adds.

Cost of the service depends on the number of cell sites and the extent of the coverage area and the number of trips a company expects to make during a season, Fishman says. Additional trips are provided at an hourly rate of $195 per hour for an 8 hour minimum, he adds. "It's almost like insurance coverage," Fishman says. STS' drivers not only know how to drive the equipment, but they also have learned snow survival skills such as starting a fire in the snow and building snow caves. In addition, STS' TSVs are equipped with global positioning satellite navigation and night vision systems for white out navigation.

STS is part of the newly incorporated Snow Operations Training Center, which for the past 10 years, has offered a snow survival school. At the school, students receive intensive extreme climate survival, emergency TSV repair and extrication, medical care, signaling for help, avalanche procedures, and navigation.

3M, PSI team up

3M Telecom Systems Division (Austin, Texas) and **PSI Telecom** (Burbank, Calif.) have formed an alliance to respond to their customers' desire for a complete outside plant product portfolio and to improve supply chain processes and services. Each company will offer the other's products through selected sales channels and the alliance will focus on ensuring product compatibility between the two companies' equipment. 3M and PSI also will launch new joint product development and manufacturing initiatives.

Court says no to franchise fees

The U.S. District Court-Eastern District of Tennessee recently revoked a City of Chattanooga, Tenn., ordinance, which levied an arbitrary fee on providers of telecommunications services. The ordinance, enacted in 1996, required competitive local exchange carriers (CLECs), such as **American Communications Services Inc**. (ACSI; Annapolis Junction, Md.), to pay a one-time fee of $750 plus 5% of their gross revenues to access the city's rights-of-way, according to ACSI.

CLECs nationwide have argued that such franchise fees constitute an unfair barrier to local competition and are in violation of the Telecommunications Act of 1996. The district court declared the Chattanooga ordinance invalid under state law alone, denying the city's right to collect franchise fees as a tax under its police powers. However, the city does have police power to charge reasonable rental fees to reimburse the costs and expenses directly related to the maintenance and repair of rights-of-way.

Network notes

Listed below are fun facts from Austin, Texas-based Technology Futures Inc.'s latest report, Transforming the Local Exchange Network: Analyses and Forecasts of Technology Change, Second Edition. Research for the report was sponsored by the Telecommunications Technology Forecasting Group, a consortium of telephone companies including: **Bell Atlantic, Bell Canada, BellSouth, Cincinnati Bell, GTE, SBC, SNET, Sprint,** and **US West**.

The nation's local exchange carriers have more than $268 billion invested in telephone plant, more than 80% of which is subject to technological displacement.By 2000, 99% of interoffice trunks are expected to be on fiber. By 2015, about 99% of all customer access lines will likely use fiber feeder.

Distribution cables will be enhanced by digital subscriber line technology, however, fiber conversion will likely be complete in the 2010 to 2015 time frame.

Interoffice trunks will be 99% synchronous optical network (Sonet) by 2005.

Ninety-four percent of loop fiber capacity will likely be Sonet by 2005. Digital switches will likely be completely replaced by asynchronous transfer mode (ATM) switches in the 2015 time frame.

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Circle 110

Robert T. Blau

Risky Business

What financial markets are telling telecommunications policymakers ... and why they need to listen.

Even in the nation's capital, getting to the right answers generally involves asking the right questions.

Just when telecommunications market experts think they have things pretty well figured out, up pops another wrinkle. The latest involves Jackson, Miss.-based WorldCom's $37 billion proposed buyout of MCI (Washington), an acquisition that WorldCom will finance entirely through the issuance of new stock. This bid preempts earlier competing offers for MCI by British Telecom (London) and GTE (Irving, Texas) of $19 and $28 billion, respectively, but also adds $7 billion to a $30 billion offer that WorldCom initially offered on Oct. 1.

Apart from being the largest corporate acquisition ever, WorldCom's bid for MCI and the stock market's response is interesting in three other respects:

- First, during the three trading days immediately following WorldCom's initial $30 billion offer, stock prices of British Telecom, MCI and WorldCom rose in response to the news by 14%, 23% and 8%, respectively. All totaled, the prospects of moving control of MCI from British Telecom to WorldCom immediately increased the combined market value of all three companies by 13%, or $12 billion.
- Second, this sudden increase in shareholder wealth coincided with—and was no doubt influenced by—reports that WorldCom would "spin off" MCI's more than 20 million residential long distance customers once the acquisition is completed. According to at least one report, WorldCom executives and Wall Street securities analysts say they do not believe MCI's residential customer base is profitable enough to sustain WorldCom's current lofty market valuation of 70 times 1997's earnings. Because keeping WorldCom's share price at or above $30 is essential to completing the all-stock deal, jettisoning MCI's residential customers may be essential to maximize the value of both companies.
- Third, and perhaps most significant, WorldCom's acquisition of MCI—along with MFS Communications Co. Inc. (Omaha, Neb.)/UUNet Technologies Inc. (Fairfax, Va.), CompuServe Corp. (Columbus, Ohio) and Brooks Fiber Properties Inc. (St. Louis)—all within the last year will give WorldCom control over very-high-capacity fiber optic backbone networks that carry an estimated 60% of all Internet traffic in the United States. How WorldCom might leverage this dominant market position to extract shareholder value from the Internet remains to be seen; what is becoming clear, however, is that the outcome of WorldCom's quest for a bigger slice of the Internet pie could have a pivotal impact on how rapidly other facilities-based carriers deploy the advanced network technologies that will be needed to sustain rapid growth of the Internet.

THE STAKES

Figure 1 illustrates just how much the Internet has meant to U.S. computer company stocks, particularly since 1994 when the World Wide Web began to develop widespread commercial appeal. Between 1988 and year-end 1993, the market weighted average price per share of the 50 leading U.S. computer hardware and software producers (e.g., Microsoft, Intel, IBM, Compaq) actually *declined* by 36% at a time when the S&P 500 rose by 129%.

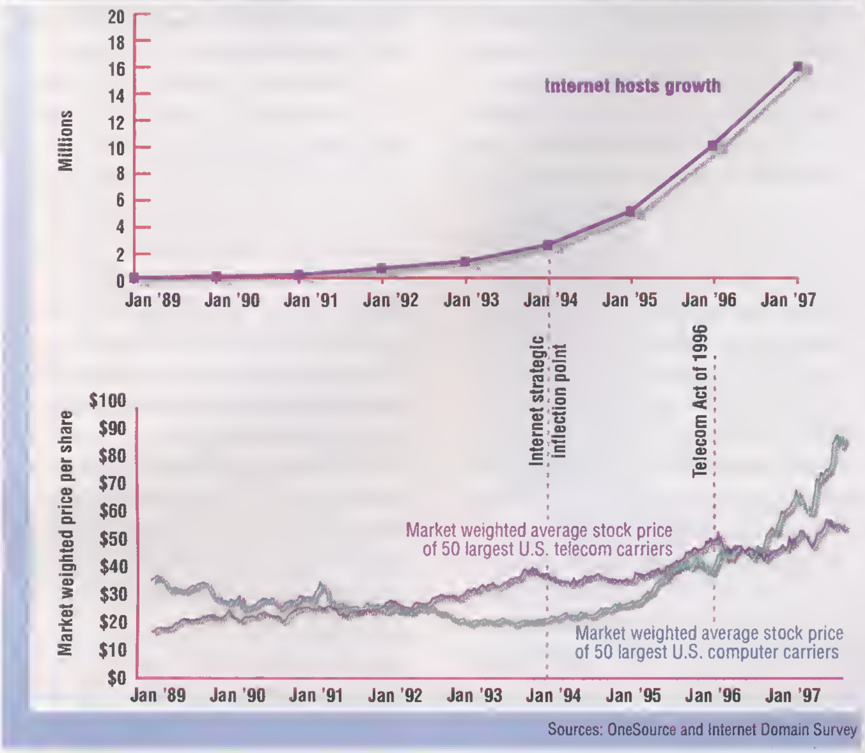
Conversely, between Jan. 1, 1994 and Oct. 1, 1997, the average price per share of these same 50 computer companies rose 229%, compared with a 118% increase in the S&P 500 and a 44% increase in the market weighted average price per share of the 50 largest U.S. telecommunications carriers (e.g., AT&T, MCI, Sprint, WorldCom, the regional Bell operating companies, GTE, AirTouch, Vanguard Cellular).

There is little doubt that the Internet is largely responsible for rejuvenating computer hardware and software sales, and subsequently digging shareholders of U.S. computer companies out of the very deep hole that they found themselves in the late 1980s and early 1990s. During that period and before the Web's supercharging of Internet growth, computer sales were, at best, lackluster. In part, this resulted from aggressive pricing from new PC-compatible equipment makers such as Compaq, Dell, Gateway, Toshiba and Hitachi, which were bent on taking market share from IBM, Apple and other dominant computer makers at almost any cost.

> **The lion's share of wealth created by the Internet has been captured almost entirely by the computer industry.**

However, the slowdown in computer sales also reflected the fact that the basic functions and capabilities of standalone desktop machines sold in the late 1980s and early 1990s were not all that much different from models sold five or even 10 years earlier. Granted, newer models could run prepackaged spreadsheet, word processing, database and graphics programs faster and with more visual effects than earlier generations, but the underlying utility and value of standalone desktop computers, particularly to consumers and small businesses, did not increase all that much—or at least enough to prompt users to replace $2,000 to $3,000 systems every two to three years, much as they do today.

Figure 1: How growth in the Internet is affecting market values of U.S. computer companies and facilities-based telecommunications carriers



Sources: OneSource and Internet Domain Survey

EXPLOSIVE GROWTH

Beginning in late 1993 and early 1994, the Web changed all of this by creating a new, easy-to-use information source for virtually any topic that users could readily access once they replaced their older PCs with newer, faster units. Investors quickly recognized the significance of this to future computer hardware and software sales, and bid up the prices of computer stocks accordingly.

Table 1 (page 74) highlights the degree to which the recent appreciation of U.S. computer stocks has added to shareholder wealth. On Jan. 1, 1994, for example, there were about 506 publicly traded U.S. companies involved in the production of computer equipment, semiconductors, prepackaged software and related technologies. Altogether, they had a total market value (i.e., price per share times number of shares outstanding) of $287 billion, representing 6.2% of the total market value of all publicly traded U.S. companies.

By Oct. 31 of this year, the number of publicly traded U.S. computer firms had risen to 866 firms with a total market value of $1.128 trillion. This represents an increase in shareholder wealth of $841 billion in less than three years, or about 17% of total gains in the market values of all U.S. stocks during this same period.

As Table 1 indicates, the lion's share of new shareholder wealth created by Internet growth has been captured almost entirely by the computer industry. This is largely because telecommunications carriers have yet to settle on a pricing mechanism that will compensate them for deploying the high-performance, packet switched networks that computer hardware and software producers will need if they are to continue adding value to their wares through the Internet.

WorldCom's acquisition of MCI, Brooks Fiber Properties, MFS and its subsidiary UUNet, and CompuServe is no doubt designed in large measure to give WorldCom enough clout in the high-performance, data networking and Internet access business to effect such a pricing strategy. If WorldCom's efforts

Table 1: Increases in market value of U.S. computer companies and facilities-based telecommunications carriers since 1994

Industry group	Market value (10/31/97) (in $ millions)	Market value (1/1/94) (in $ millions)	Change (%)
Computer equipment (SIC 3570,3571,3572,3576,3577,3672)	435,961.02	126,672.46	244
Semiconductors (SIC 3674)	216,197.32	49,648.72	335
Prepackaged software (SIC 7372)	335,830.26	74,748.00	349
Other (SIC 7370,7371,7373,7374,7377)	139,962.61	35,951.05	289
All computer firms	***1,127,951.22***	***287,020.23***	***293***
Local telephone companies	273,833.07	198,610.02	38
Long distance carriers	182,639.72	108,876.45	68
Cellular telephone operators	45,759.04	33,504.81	37
CATV operators	34,093.73	24,431.08	40
Competitive local exchange carriers	15,473.12	$95.30	16,136
Telecom equipment manufacturers (SIC 3669, 4899, 3663,3661,7385)	169,260.18	58,738.67	188
All telecom	***$721,058.86***	***$424,256.32***	***70%***
All U.S. publicly traded companies	***$9,747,972.44***	***$4,635,577.02***	***110%***

The combined market value of telecommunications equipment makers as of Oct. 31, 1997, includes $52.8 billion for Lucent Technologies, or about 31% of the telecom equipment total. Separate market values for Lucent are not available for Jan. 1, 1994, since the company was part of AT&T at that time. Thus, the implicit market value of AT&T's manufacturing arm in 1994 is reflected in the long distance category—AT&T's principal line of business.

Source: OneSource

are successful, other carriers will follow suit, public policy permitting.

How U.S. computer companies respond to all of this will be of considerable interest not only to the telecommunications industry but also to its regulators. Some computer concerns will resist any effort on the part of WorldCom or other network providers to impose additional charges for upgraded Internet access. They will do so out of concern that higher prices may slow near-term growth of the Web and related equipment sales.

Others, however, may be more concerned that, if facilities-based telecommunications carriers do not accelerate investment in high-performance, packet data networks, Internet service will not have the bandwidth needed to continue adding value to the Web by innovating new service applications. A bandwidth shortage could pose an even greater threat to Internet growth and the future demand for new generations of semiconductors, computer equipment and prepackaged software that the computer industry is counting on the Internet to create.

POLITICAL AND BUSINESS IMPLICATIONS

Even with a $840 billion run-up in U.S. computer stock prices since 1994, the creation of shareholder wealth may represent a mere fraction of overall economic benefits spawned by the Internet and its rejuvenation of the U.S. computer industry. In 1992, Bill Clinton and Al Gore fashioned their first presidential campaign around a platform of economic recovery fueled by high technology. They did so partly because many experts then predicted that Japan soon would dominate the global computer hardware and software markets, thereby giving it a major competitive edge in a variety of businesses that rely heavily on computers to produce better products at lower costs.

This, obviously, did not come to pass. Now, economists inside and outside the federal government are debating whether the massive investments in computer and communications technologies that U.S. businesses have made in recent years are finally beginning to pay off in the form of permanent increases in productivity, real economic growth and standard of living. Some, including Federal Reserve chairman Alan Greenspan, have gone so far as to suggest that explosive growth of the Internet and related computer and communications technologies has played a major role in pushing the U.S. economy and stock markets to new heights. Such developments were instrumental in the re-election of Clinton and Gore, as well as the recent agreement between the Clinton administration and Republican leaders in congress to balance the federal budget while preserving various social welfare programs.

Therefore, a question of paramount importance to U.S. businesses, public policymakers and politicians alike, is how best to keep a good thing going?

NO EASY ANSWERS

Unfortunately, the answers are not all that clear. Leading computer companies such as Intel, Microsoft and Sun Microsystems assert that if they are to continue adding value to the Internet by innovating new service applications, telecommunications carriers will need to provide substantially more bandwidth to residential and small business users than is available at widely affordable rates.

Former Federal Communications Commission (FCC) chairman Reed Hundt apparently agrees. In recent speeches, he has warned of an "infrastructure meltdown" and likened the local telephone companies to a "$300 billion sunk cost, circuit-switched, beached whale." He further suggested that the telecommunications industry stop trying to squeeze more data through today's narrowband circuit switched telephone network and, instead, build a parallel packet switched data network that can accommodate growth in Internet traffic.

While the opportunities (and risks) to the information sector and the larger economy of rapid (or sluggish) local broadband network developments are clear, what to do about the problem is not as clear.

Standard investment models suggest that investment is associated with risk, uncertainty, delay, earnings, growth and other matters that government processes influence, especially in this sector. Earnings and growth opportunities will attract investment, risk and regulatory uncertainty, and delay drive funds into other sectors here and abroad.

Too many regulators and politicians focus chiefly on the short term. It may be too much to expect that the FCC and other regulatory agencies will leave more dollars on the table for regulated carriers to use for investing in local broadband distribution. But it is also too much to expect that regulated carriers will risk scarce capital in markets that are micromanaged by regulators in ways clearly designed to transfer wealth from incumbent telephone companies to sundry new entrants and large customers. That leaves a dilemma.

What to do? One approach is to free new data communications services, such as assymetrical digital subscriber line (ADSL), from the strangling yoke of conventional common-carrier regulation. Taking this important step would avoid inevitable regulatory delays in new-service introduction that strip consumers of value and signal markets to send funds elsewhere. It also would insulate the Internet and U.S. computer industries from other vagaries of the current telecommunications policy-making process. New data services are more competitive than the average bundle of services provided by incumbents; thus, there is less need for regulation.

> **Economists are now debating whether investments in computer and communications technologies are paying off.**

Finally, better tests for gauging the need for regulation should be developed. These tests should relate to the status of services, not carriers. Like it or not, the local telcos may continue to serve the lion's share of basic exchange service customers for a long time, partly because competitive carriers such as WorldCom have no real interest in serving residential users. Why should Aunt Minnie be doubly punished and denied new services by incumbent carriers on grounds that new local service entrants will not offer her a competitive alternative for plain old telephone service?

In the words of one well-known and very wealthy nerd, "that doesn't compute." ■

Robert Blau is vice president of executive and regulatory affairs at BellSouth Corp. (Atlanta). He can be reached at blau.robert@bsc.bls.com. (The views expressed in this article are those of the author and are not necessarily shared by BellSouth.)

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DAVID KOPF

The need to know NEBS

As ISPs push servers out to COs, NEBS compliance becomes crucial.

FOR INTERNET SERVICE PROVIDERS (ISPS), THE IMPORTANCE OF KNOWING THE NETWORK EQUIPMENT BUILDING STANDARD (NEBS)—BELLCORE'S LONG-STANDING EQUIPMENT SPECIFICATIONS FOR FAULT-TOLERANCE THAT COULD SEEMINGLY DEFY AN A-BOMB—HAS BECOME A NECESSITY. AS ISPS MOVE MORE AND MORE EQUIPMENT OUT TO THEIR POINTS OF PRESENCE (POPS), OFTEN LOCATED AT TELCO CENTRAL OFFICES (COS), NEBS KNOW-HOW SOMETIMES BECOMES THEIR ONLY TICKET TO COLLOCATING EQUIPMENT AT THE FACILITY.

Basically, NEBS was designed by the telco community decades back to handle a number of problems associated with housing a large amount of very expensive, yet delicate equipment in the same facility. The NEBS specifications address every possible CO hazard from electrical shielding to powering to acts of God such as earthquakes and fires (the so-called "shake and bake" test).

In order to make the CO muster, ISPs are now learning how important NEBS can be to their business.

THE BIG PUSH

For ISPs, moving servers close to users is a multifaceted masterstroke of efficiency that most can't do without. For one, it saves ISPs large amounts of bandwidth in the long haul, says Chris Yetman, director of server administration and network support analysis for GTE Internetworking (Cambridge, Mass.). For another, it means improvement in network performance that end users can perceive, which is an obvious service differentiator, he says.

Where long-haul traffic is concerned, Yetman says Usenet news illustrates perfectly how much bandwidth ISPs can save by decentralizing servers. "You're taking the same articles and you're replicating them across the network to customers over and over and over again, according to whatever subscription lists they have," he says.

"So if I have a news feed machine—a server that's feeding this news to, say, 300 customers—and it's sitting in a regional location or a centralized location, then each of those 300 feeds might average 200 KB, so that's going to add up to 6 or 60 Mbps, and it could swamp a T3," Yetman says.

That's bandwidth GTE could otherwise be selling, Yetman says. It only makes sense to move servers forward.

ENTER NEBS

To move servers out to customers, ISPs need only jump one hurdle: live up to CO standards—and that means NEBS, the passkey into POPs.

In the case of GTE Internetworking's forward-server strategy, NEBS was a must. "The biggest reason is that it's just a lot easier to get into a POP," Yetman says. "You can be NEBS-compliant and get into almost anyplace they might not let you into, otherwise.

"The other thing is that the equipment just runs better," he adds. "It's kind of like a milspec [military specification], so [NEBS equipment has] got a much more solid design criteria against it. NEBS has to be able to do certain things and survive. By nature, [NEBS equipment] has a tendency to be overdesigned compared to what you'd get regularly."

GTE Internetworking (then BBN Corp.) began deploying GNP Computers' (Monrovia, Calif.) NEBS-compliant WorkServer platforms nationwide to its POPs. When GTE's CO engineers, the people who were to interface CO equipment with Internetworking's incoming forward servers, Yetman says "They were saying things like 'We can do that. I can put that almost anyplace.' "

POWER PERFORMANCE

Apart from any smiles NEBS-compliant equipment may put on CO staffers' faces, NEBS also means performance gains, especially in power, Yetman says.

In the last year or so, GTE Internetworking has converted almost all of its POPs to DC power, he says "I'm telling you right now that there's probably lots of factors that have increased our network reliability, but I am convinced [DC power is] one of the very noticeable ones. The power's just always there.

"The phone companies have some fantastic infrastructure in terms of power," he continues, and to not take advantage of that would be "ludicrous."

For instance, most people can recall using their phone during a power outage, Yetman says. Plain old telephone service users expect the 99.999% service availability that NEBS-compliance helps to make possible. ISPs that build NEBS into their networks might gain a strong service differentiator, says Roger Bahr, GNP president.

"The standards have been outlined for decades," Bahr says, "and have been an important part of leading to the expectations of quality of service." ■

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30 ○ 25 **Data Communications/Digital/IS/MIS Mgmt.** (Data Communications, Digital, I/S VP, Director or Mgr.)
31 ○ 13 **Mgmt.** (VP, General Mgr., System Mgr., Mgr., Director)
32 ○ 3 **Corporate Mgmt.** (Chairman, Owner, President, Partner, Executive/Senior VP/Director, Treasurer, CFO, COO)
33 ○ 4 **Legal, Financial, Regulatory or Processing Services** (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
34 ○ 5 **Personnel & Administrative Services** (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
35 ○ 16 **Sales/Marketing** (Sales or Marketing VP, Director, Mgr., Representative)
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40 ○ C **Transmission and Broadband Distribution Equip./Services** (Digital Loop Carriers, Sonet, T1, Microwave, Satellites, Digital Cross Connects, Amplifiers, Passives, Cable, Long Haul Transmission Systems, Loop Distribution and Electronic Systems, Multiplexers)
41 ○ D **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
42 ○ E **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
43 ○ F **Outside Plant and Construction Equip./Services** (Pedestals, Vehicles, Towers, Tools, Enclosures)
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new users logging on within the past three months, says a recent survey of U.S. Internet and online usage conducted by market researchers **IntelliQuest Information Group Inc.** (Austin, Texas).

The study also found that 16 million more adults intend to use the Internet or online services within the next year, potentially boosting the total U.S. online adult population to 72 million (if they follow through on their intentions). This would represent a doubling of the online population since Q2 1996, IntelliQuest says.

Of those people planning to get online, most represent mainstream America: 60% of the potential users are age 35 years or older, 47% have a high school education or less and 65% have household incomes less than $50,000, according to the study.

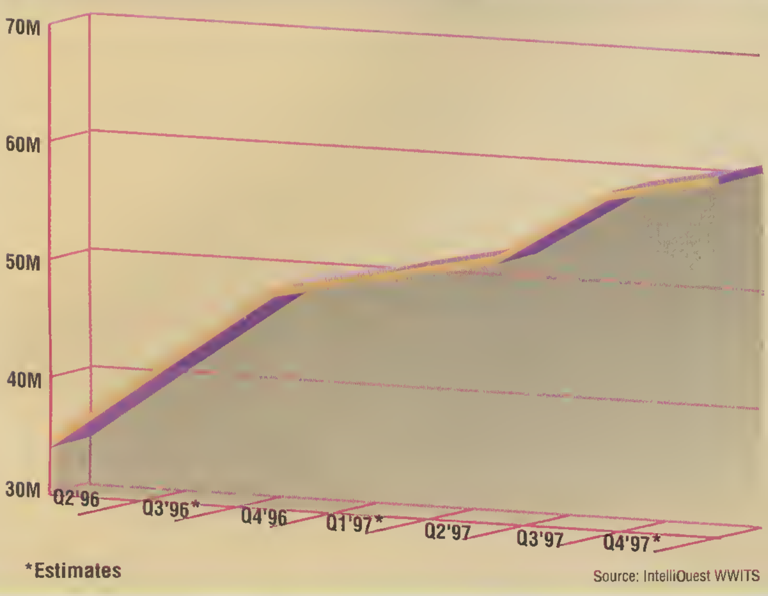
The study also shows that the 'Net and online services are becoming mainstream factors in users' day-to-day lives and work.

"The thousands of users we have interviewed over the course of this study are telling us that the medium is becoming more mainstream in their lives," says Tom Fornoff, managing director of Internet services for IntelliQuest. "They are getting online from more locations, spending more time online, performing a wider variety of activities and finding it to be a highly useful channel for shopping and buying."

More than 23 million users (42% of the online population) say they've accessed the Internet or online services from multiple locations in the third quarter. Users currently spend a mean level of 9.8 hours a week logged on to the Internet or online services, up from Q2 1996's 6.9 hours a week. Also, commerce grew from a base of 2.6 million online purchasers in Q2 1996 to 8.7 million electronic shoppers in Q3 1997, with annual projected spending to hit $7 billion annually, according to IntelliQuest.

The study also shows that while many new users may go online, many of them leave. More than 10 million people said they no longer access the Internet or online services, largely because, one, they no longer have access, or two, they no longer find the services useful, IntelliQuest says.

U.S. population age 16 and above accessing the Internet or online services



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INTERNET Notebook

David Kopf

NCs to gain as much as 11% of desktop market by 2001

The market for network computing-based services may be increasing.

Although network computers (NCs) are projected to make up less than 1% of 1997's total market for new desktop computers, they will gain as much as 11% of that market by 2001, according to a recent **Datamonitor** (New York) survey of worldwide desktop hardware makers and corporate end users.

However, PCs are nowhere near from becoming extinct. Instead, the traditional PC will simply cease to own a monopoly over corporate desktop computing, says Datamonitor analyst Randy Gernaat. While NCs may have a rapid growth spurt, and any efficiency or cost advantages NCs may have over standard desktop PCs, the survey also indicated that PC makers and corporate users believe the desktop PC will still dominate the market, the study shows.

Also, Datamonitor says that NCs and other devices that use thin client software to use applications running on remote servers will achieve higher market volumes NetPCs, which function more like stripped-down PCs and don't rely on remote servers as much. NC sales volumes are expected to rise from just over 400,000 by year-end 1997 to nearly 7 million by year-end 2001, while NetPCs are projected to hit under 3 million in the period, the study says.

AT&T unveils VPN services

AT&T (Basking Ridge, N.J.) has debuted its AT&T WorldNet Virtual Private Network Service (VPNS), which it says will offer end-to-end service guarantees with an IP backbone designed to provide 99.7% network availability (subject to restrictions and limitations within customer contracts).

The VPNS network supports a latency of 150 milliseconds or better between two AT&T-managed customer sites. The service supports dedicated connections, and provides dial-up access support up 56 Kbps connections via more than 300 local dial points of presence as well as toll-free access. AT&T's VPNS also offers various management and security features.

Internet, online services see 4.9 million new adult users in last 3 months, total hits 56 million

Fifty-six million adults, or 27% of the U.S. population age 16 and older, have gone online as of Q3 1997 (see Figure below), with 4.9 million new users logging on within the past three months, says a recent survey of U.S. Internet and online usage conducted by market researchers **IntelliQuest Information Group Inc.** (Austin, Texas).

The study also found that 16 million more adults intend to use the Internet or online services within the next year, potentially boosting the total U.S. online adult population to 72 million (if they follow through on their intentions). This would represent a doubling of the online population since Q2 1996, IntelliQuest says.

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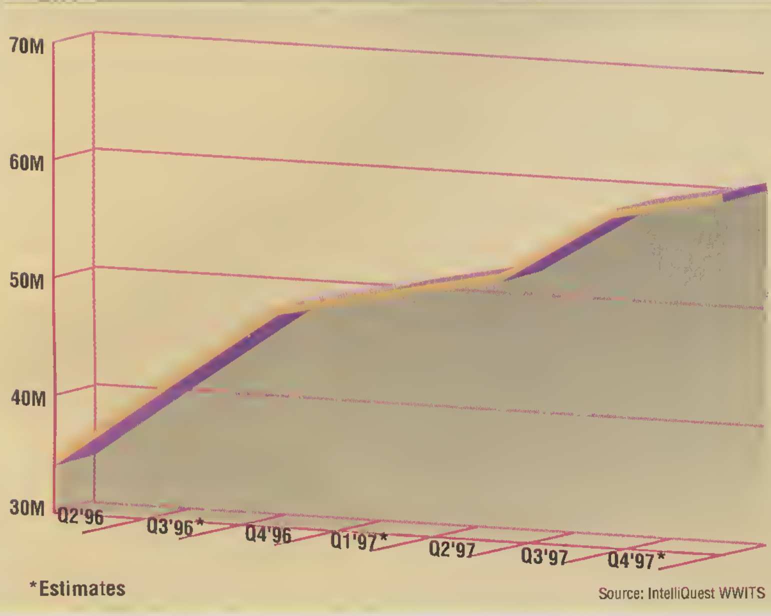

*Estimates

Source: IntelliQuest WWITS

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FROM THE AMERICA'S NETWORK ARCHIVES

Twenty years ago the American Telephone & Telegraph Co. was one of five companies participating in a U.S. Department of Energy electric vehicle testing program according to an article in the November 1978 issue of *Telephone Engineering & Management.* AT&T began testing the first 20 of 35 vans in the garage of Pacific Telephone. The remaining vans were tested in other cities. (Who would have guessed consumers would have to wait as long as two decades until General Motors' EV1 became available?)

The $20,000 AT&T vans, with a range of 40 miles and a top speed of 50 mph, were used in daily installation and repair activities. Plans called for the vehicles to be recharged in the garage overnight—during off-peak-time for energy consumption. At the time, AT&T estimated that as many as 20,000 of its vehicles could be electrically powered. Hopes of adding another 20,000 vans and trucks out of the company's 177,000 was the goal. AT&T shared the costs of its part of the test program with the Department of Energy, but paid for normal vehicle operation expenses.

—Debbie L. Sklar

BEYOND the CALL OF DUTY

When Victor Diaz saw people trapped in a burning Harlem building one day last year, he used his keen intuition (not to mention his backhoe) to save the lives of 12 individuals—seven of them children. In September, Bell Atlantic awarded Diaz the Theodore N. Vail Medal for Public Service in recognition of his quick thinking and heroic actions.

The 49-year-old construction equipment operator for Empire City Subway is the first winner of the Vail Awards since Bell Atlantic merged with Nynex in August. He has served for 26 years with the company. The award, named in honor of the first president of the Bell System, recognizes telephone industry employees who have demonstrated heroism and unusual merit in the course of doing their jobs.

On March 12, 1996, Diaz was busily excavating part of an intersection in Harlem so other telephone technicians could upgrade cables in the area. He used his backhoe to lower those trapped in the fire, when the building's fire escape ladder couldn't be freed.

Diaz also is the first private citizen to receive the "Caring New Yorker" award from the state's attorney general, Dennis Vacco. *—D.L.S.*

BLACK DIAMONDS on the SUPERHIGHWAY

Just in time for holiday vacations, SkiAlert, a new wireless "push" service from Intelligent Information Inc. (Stamford, Conn.), is delivering reports on current snow conditions to alphanumeric pagers, PCS handsets and other wireless devices belonging to today's busy schussing families.

Reports include ski area and state; snow report and number of new inches; base depths; current surface conditions; lifts in service; and open trails. For example, a message for Aspen Mountain in Colorado could look like this: Aspen Mountain (CO); New: 5, Depth: 41, Surface: Powder, Packed Powder, Lifts: 6, Trails: 71.

SkiAlert is available to wireless carriers as a value-added service for mobile telephone handsets and alphanumeric pagers. Customer service can be handled via Internet connections, interactive voice response systems, or by fax or live operator.

The service also can be configured for two-way wireless devices, allowing users to enter the name and state of their mountain of choice into their pager or PCS phone, and receive a current condition report seconds later.

Intelligent Information Inc. also will launch the reported first wireless "pay-per-view" service when it brings specialized coverage of the Winter Olympics games delivered as text messages to phones and pagers. Wireless users signing up for the service will receive three timed messages a day throughout the course of the games: a morning medal winners summary of the previous evening's activities; a mid-day message including winners for minor events and Team USA hockey; and an evening message including breaking news, event previews and medal updates.

Ascend unveils end-to-end xDSL system

Ascend Communications Inc. (Alameda, Calif.) has unveiled a carrier-class concentrator and SDSL-based CPE router which, when combined, provide an end-to-end solution for carriers wishing to provision xDSL services.

The DSLTNT central office (CO) concentrator supports a range of xDSL services—including IDSL, SDSL, RADSL-DMT and RADSL-CAP—as well as traditional data services. The concentrator reportedly features the highest port density of any remote access concentrator along with the lower power consumption required by carriers. The DSLPipe-2S is a customer premises router that bonds two SDSL lines together for up to 1.544 Mbps bandwidth (T1). The router also can provide 768 kbps transmission over a single SDSL line.

"It is extremely important to have a flexible platform so that we can adapt our services as market demand evolves," says Mike Henry, president of MegaINet Inc. (Chicago). The DSLTNT provides "plug and play" modularity, he says.

"Carriers can only keep up with [xDSL] demand by pulling together their own solutions using multiple products from different vendors," a method that can be costly and harder to manage, according to Ashok Dhawan, general manager of high-speed access products at Ascend. Carriers and Internet service providers (ISPs) can replace banks of DSL modems, Ethernet switches and routers at the CO with the compact DSLTNT concentrator.

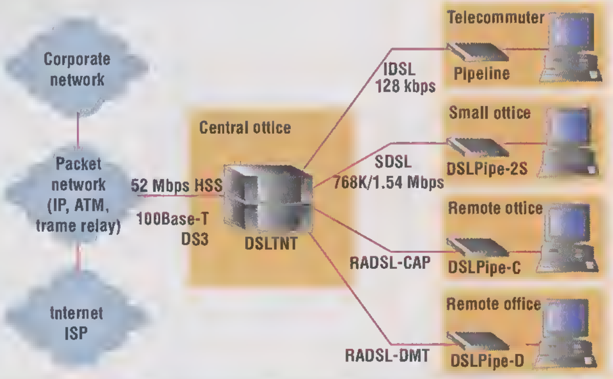
The DSLPipe-2S router can support T1-equivalent bandwidth that service providers can, in turn, sell to their corporate customers. The CPE router provides full security, including support for industry-standard PAP and CHAP authorization and authentication protocols, remote provisioning and management, as well as the ability to consolidate IP/IPX and frame relay traffic over the same line, according to Ascend.

With one platform, carriers can deliver xDSL services to corporate users, ISPs, and home office workers and telecommuters. A standard 7-ft. rack supports either 1,344 IDSL ports; 1,440 SDSL ports; 540 RADSL-CAP ports; or any mix of services. Plug-in network cards are available for DS3, HSSI, T1, E1, serial WAN, 10BaseT and 100BaseT Ethernet.

Moreover, because the system supports a variety of virtual private network (VPN) protocols (including L2TP, PPTP, ATMP, FR Direct and IP Direct), carriers can offer VPN services to corporate customers or segment their own networks so they can resell bandwidth to smaller ISPs.

Both systems are part of Ascend's MultiDSL product family. The DSLTNT base chassis with ADSL support lists for $8,900. RADSL-CAP modules were being sold at press time for $4,995 (six-port card). The DSLTNT features softkey upgradability to SDSL and IDSL. The DSLPipe-2S sells for $1,650.

Fax 510/814-2300 or Circle 250.



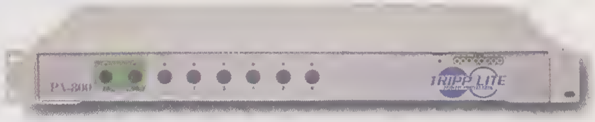
Power and Protection Focus

Remote systems power administration

The Power Administrator remotely reboots and controls power to network devices to increase network uptime and reduce field service calls. In the event of a power loss, the system preserves uninterruptable power supply (UPS) for critical systems by allowing technicians to select and power-down outlets serving non-critical devices. Each unit features a low-profile, rack-mount design and has six individually controllable outlets. Optional expansion units can be linked for full scalability up to 128 outlets, while still requiring only one network or modem connection.

Tripp Lite (Chicago)

Visit www.tripplite.com or Circle 255



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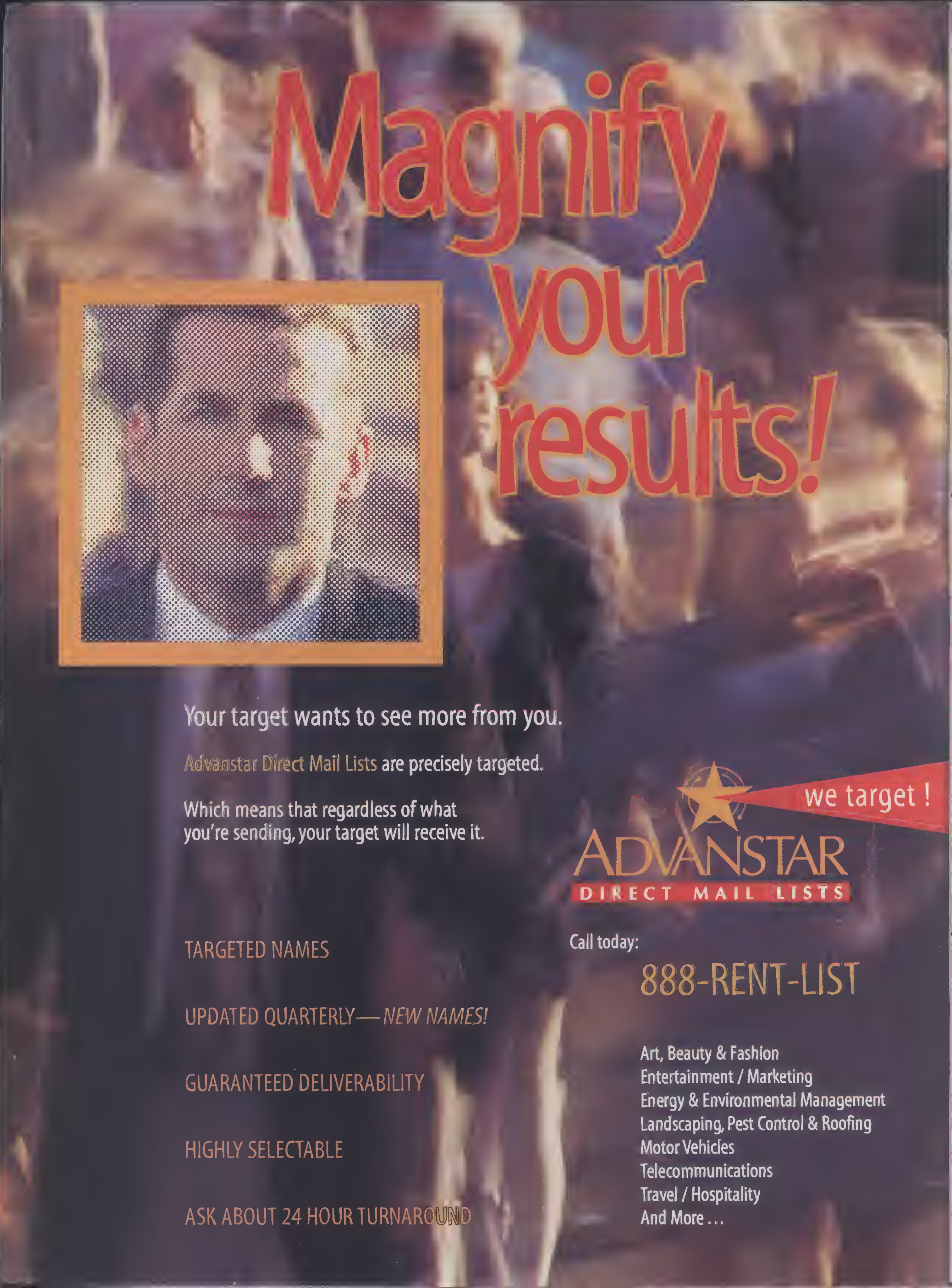

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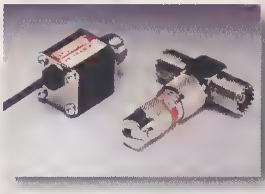

RF-Trab products protect antenna inputs of radio frequency (RF) transmission and receiver communication systems from damaging surge voltages. Transient energy can be coupled onto these systems from lightning, utility power switching and internal inductive load cycling. The protective circuit is designed to shunt damaging surge energy safely to ground before it can cause damage to sensitive RF equipment.

The products are engineered for minimum attenuation of high frequency RF signals. Versions are available with type "N" or ultrahigh frequency (UHF) connectors, which enable installation without special adapters or hardware. *Phoenix Contact Inc. (Harrisburg, Pa.)*

Visit www.phoenixcontact.com or Circle 263

Cyclon cells

The operating temperature range has been extended for the Cyclon single cell product line. Extensive testing has verified that pure lead-tin rechargeable batteries perform through a temperature range of –65°C to +80°C. The batteries can survive continuous exposure to 80°C up to 60 days.

The cylindrical design of the cells combined with pure lead-tin electrochemistry account for the product's ability to survive extreme temperatures. The purity of the grid inhibits grid corrosion and venting of acid vapors. The starved electrolyte system prevents dryout by efficiently recombining gases, which reduces water loss. Low internal resistance and pure lead-tin grid provide longer service life and more high-rate power than conventional batteries of comparable size. Single cells can be combined in series or parallel to meet voltage, ampere-hour and space requirements. *Hawker Energy Products Inc. (Warrensburg, Mo.)*

Visit www.hepi.com or Circle 252

Fiber optic training

A series of eight "how-to" fiber optic training series videos include presentations on performing optical loss testing; understanding and using optical time domain reflectometers (OTDRs); preparing fiber optic cables; how to cleave, polish and inspect a fiber optic connector; performing a fiber acceptance test; singlemode fiber optic emergency restoration; how to perform an optical loss budget; and splicing and cleaving optical fibers. The cost of the videos is $100 for small quantities. *The Light Brigade (Kent, Wash.)*

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Circle # 115

Power and Protection Solutions continued

UPS with individual outlet switching

Anzen uninterruptable power supplies (UPS) with individual outlet switching let users turn off parts of the UPS load without affecting other connected equipment.

Together with IPT Vision UPS management software any Anzen UPS can be configured to shed less critical loads during extended outages and provide longer runtime to more critical devices. These UPSs reportedly offer the best voltage regulation of any line-interactive UPS, intelligently reducing overvoltages and boosting brownout without using precious battery power.

When the UPS switches to battery power, it produces only pristine sine wave output with less than 3% total harmonic distortion (THD). Quasi-sine wave or stepped-wave output produced by other UPSs can harm sensitive electronics applied over an extended period of time. *International Power Technologies (Orem, Utah)*

Visit www.iptinc.com or Circle 253

Expandable cabinets

Customized cabinets accept any copper, coax and fiber optic combination. Their modular design can be combined with cross-connect or terminating systems for easy access, fast installation, and maintenance and quick-jumping capabilities. The 4200 Series cabinets house from 300 to 5,400 pairs with ample space for splicing; additional frames can be installed to accommodate growth or changes in network traffic. Removable skirts and backs, split cable ports and drop-down interior frames simplify cable installation. Electronic and fiber optic equipment can be added with vertical mounting hardware.

The cabinets feature heavy gauge construction and sealed, lockable doors, weather-stripping and ventilation flow to protect equipment from extreme environmental conditions. A cabinet-to-base isolation system resists moisture, rodents and insect attacks, eliminating the need for pea gravel. *3M Telecom Systems Division (Austin, Texas)*

Visit www.mmm.com/telecom or Circle 251

Products and Services

Direct fusion splicing

The Fuselite Termination System combines connector and fiber fusion splicing, and allows direct fusion splicing of a factory-polished connector to fiber optic cable. The system provides a connectorization option at no additional cost, and converts from a connector splicer to a fiber-to-fiber micro splicer in seconds. It can be used for system maintenance and restoration, broadband applications, aerial splicing and new construction. The Fuselite connector is a "near-zero-length" pigtail with a fiber stub installed in the ferrule and polished in the factory. The special ferrule design allows fusion splicing within the connector housing. *Siecor Corp. (Hickory, N.C.)*

Visit www.siecor.com or Circle 256

Physical Layer testing for T1, E1

Tekelec has partnered with VL Laboratories to provide Physical Layer testing for T1 and E1 rates on the Chameleon Open Protocol Analyzer. The addition of physical layer testing enables unit commission, acceptance test and monitor capabilities. The bit error rate test (BERT) application module is a hardware and software-based solution offered to run on the analyzer. With a distinguishing Windows-based, easy-to-use interface, the point-and-click application saves time and reduces programming configurations, which then can be saved and reused. *Tekelec (Calabasas, Calif..) and VL Laboratories (Lotus, Calif)*

Visit www.tekelec.com and www.vllabs.com or Circle 261

Parallel pull cable lasher

The Apollo Aerial cable lashing machine provides parallel-pull at a low weight, and securely lashes single or multiple installation of copper, fiber and coaxial cable. The machine also can lash combinations of cable and innerduct. All-smooth edges provide 360 degrees of protection against cable damage.

The cable lasher weighs less than 35 lbs. without lashing wire. It can lash cable bundles up to 4"—in 1/4" through 3/8" diameter strands—satisfying size requirements of almost all users. *General Machine Products Co. Inc. (Trevose, Pa.)*

Visit www.gmptools.com or Circle 257

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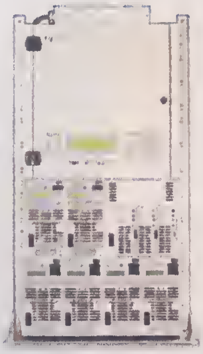

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Fiber optic transmission link

The Model 2792 Excellinx FM fiber optic transmission link provides contribution and distribution quality baseband video and unbalanced stereo audio transmission. The links can be used with singlemode or multimode fiber, transmitting video and stereo audio more than 90 km over singlemode and 15 km over multimode fiber. The Model 2792 is available in 850 nm, 1300 nm, and 1550 nm wavelengths. Standalone or rackmounted, the link can be used for media retrieval, teleconferencing, distance learning, electronic magistrate and security. *Force Inc. (Christiansburg, Va.)*

Visit toreceinc.com or Circle 259

Low-traffic switching

The Access Node System (ANS) supports PSTN, ISDN and Intelligent Network (IN) services, and is designed for applications where low traffic densities cannot financially justify larger capacity exchanges. A sample installation could begin as a local exchange serving PSTN users; later, the installation could be reconfigured to include ISDN lines or to become a traffic concentrator feeding into a larger AXE network.

ANS Local 1 is a complete local exchange in a single equipment cabinet. ANS Translocal 1 provides a small networking solution with all the cost advantages of larger infrastructures, and can be configured as a local switch, a service switching point (SSP), a transit exchange or any mix of the three. *Ericsson Infocom Systems (Stockholm)*

Visit www.ericsson.com or Circle 260

ATM emulator

The ATM Network Emulator (ANE) distributed software emulation suite is a test bed for ATM products for interoperability standards compliance and performance. Because ANE implements ATM protocols and signaling software, there are no models to develop and maintain and no simulations to perform. ATM networks of any size and topology can be created by freely mixing emulated and real elements that support user-to-network interfaces (UNIs) and private network-to-network interface (PNNIs), including PNNI routing.

Configuration and control is handled centrally from a single workstation, and various network elements are emulated by multi workstations. The emulator analyzes and characterizes network behavior such as traffic loads, congestion and faults. Each simulated application includes a load generator, control panel protocol exerciser and service refill generator. A built-in protocol analyzer helps troubleshoot and diagnose failures. *Duet Technologies (San Jose, Calif.)*

Visit www.duettech.com or Circle 258

New product information should be submitted to Debbie Sklar, Solutions editor, at *America's Network*, **714/513-8698; Fax: 714/513-8634 • dsklar@americasnetwork.com**

SNMP OR TL1 ALARM REMOTE
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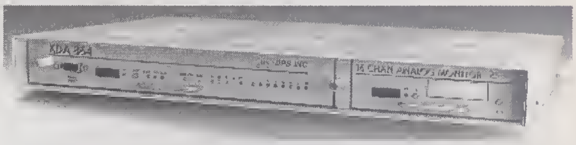

Base unit supports 64 alarm inputs and has 8 relays to control external devices. Additional units may be cascaded for more capacity.

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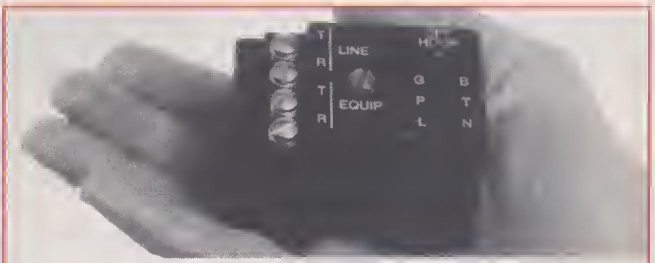

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Circle # 119

Itinerary

Date	Event	Organizer/Sponsor	Location	For Information
Jan. 11–14	**PTC'98**	**Pacific Telecommunications Council**	**Honolulu**	**808/941-3789**
Jan. 14–16	Prepaid Wireless Services	AG Communication Systems	Coral Gables, Fla.	800/999-3123
Jan. 20–23	**Supercomm Mexico**	**Telecommunications Industry Assn.**	**Mexico City**	**703/907-7700**
Jan. 21–23	Wireless Showcase Asia	Personal Communications Industry Assn.	Singapore	703/739-0300
Jan. 26–29	**Comnet '98**	**IOG Communications**	**Washington**	**800/225-4698**
Feb. 9–12	Western Communications Forum	International Engineering Consortium	Dallas	312/559-4111
Feb. 10–11	**Wireless Interconnection '98**	**Bellcore**	**Orlando, Fla.**	**800/521-2673**
Feb. 10–13	ExpoComm Mexico'98	E.J. Krause & Assoc. Inc.	Mexico City	301/493-5500
Feb. 15–19	**NTCA Annual Meeting & Expo**	**National Telephone Cooperative Assn.**	**Atlanta**	**202/298-2328**
Feb. 18–20	Louisiana: Annual Convention	Louisiana Telephone Assn.	New Orleans	504/927-1377
Feb. 22–27	**Optical Fiber Communication Conference and Exhibit**	**OSA/IEEE**	**San Jose, Calif.**	**202/223-0920**
Feb. 23–25	The New Horizons of Wireless '98	Cellular Telecommunications Industry Assoc.	Atlanta	800/424-5249
Feb. 24–27	**Comdex Mexico**	**E. J. Krause & Assoc. Inc.**	**Mexico City**	**301/493-5500**
Feb. 25–26	IMT 2000 Wider Band CDMA Conference	Wireless Institute of Technology	Atlanta	510/490-6459
March 3–6	**Global TMN Summit**	**Vertel**	**Orlando, Fla.**	**818/227-1424**
March 10–12	Telecom Business/ TeleCard World	MultiMedia Publishing Corp.	Dallas	713/974-5252
March 15–18	**WRTA Convention**	**Western Rural Telephone Assn.**	**Las Vegas**	**707/538-7755**

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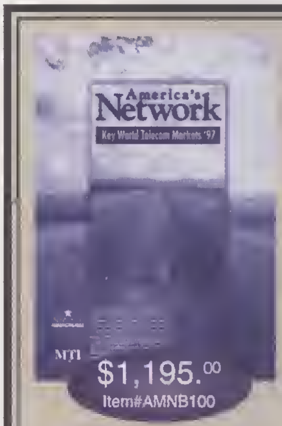
Date	Event	Organizer/Sponsor	Location	For Information
March 22–25	MTA Annual Convention	Minnesota Telephone Assn.	Minneapolis	612/291-7311
March 24–27	Carolinas, Virginia: Spring Meeting	Carolinas-Virginia Membership Assn.	Williamsburg, Va.	910/592-5751
March 30–April 2	InterComm '98	Telecommunications Industry Assn.	Toronto, Ont.	703/907-7700
March 31–April 3	Telexpo'98	Telecommunications Industry Assn.	São Paulo, Brazil	703/907-7700
April 1–2	North Dakota: Annual Meeting	North Dakota Telephone Assn.	Bismarck, N.D.	701/223-6022
April 20–23	Expo Comm USA	E. J. Krause & Assoc. Inc.	Chicago	301/493-5500
April 28–May 1	Communications '98	E. J. Krause & Assoc. Inc.	Beijing	301/493-5500
May 3–6	Cable '98	National Cable Television Association	Atlanta	202/775-3669
May 12–16	Sviaz/Expo Comm Moscow	E.J. Krause & Assoc. Inc.	Moscow	301/493-5000
June 7–11	Supercomm'98	USTA/TIA	Atlanta	800/278-7372
June 11–13	Infocomm '98	Infocomm International	Dallas	703/273-7200
June 14–16	Illinois: Annual Convention	Illinois Telecommunication Assoc.	Lake Ozark, Mo.	217/525-1044
June 14–17	Global Information Infrastructure: Global Implications and Imperatives	Pacific Communications Council	Alyeska, Alaska	808/941-3789
Sept. 2–4	Telecom Business/ TeleCard World	MultiMedia Publishing Corp.	New York	713/974-5252
Sept. 29–Oct. 2	Expo Comm Argentina/ Telecomunicaciones	E.J. Krause & Assoc. Inc.	Buenos Aires, Argentina	301/493-5500
Sept. 30–Oct. 2	ComNet	IDG Communications	San Francisco	781/551-9800
Oct. 6–8	Expo Comm UK	E.J. Krause & Assoc. Inc.	London	301/493-5500



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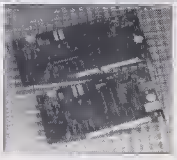

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